This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 427168

TRANSACTIONS

—OF—

The National Association of Cotton Manufacturers.

SUCCESSOR TO

New England Cotton Manufacturers' Association,

ORGANIZED AS THE HAMPDEN COUNTY COTTON SPINNERS' ASSOCIATION.

Founded 1854. Incorporated Dec. 1, 1894.

NO. 84.

ANNUAL MEETING.

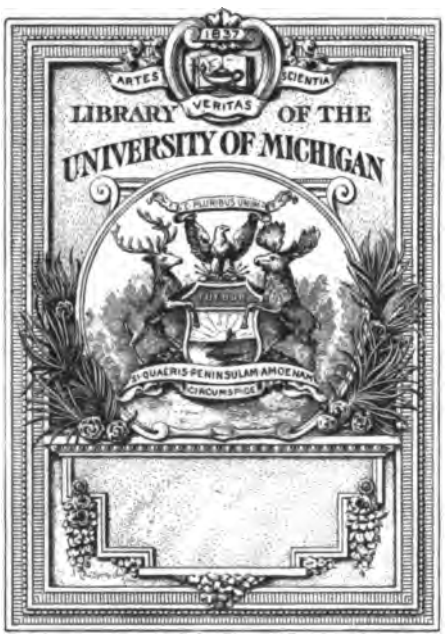
Held in Huntington Hall, Massachusetts Institute of Technology,
491 Boylston St., Boston, Mass.

APRIL 16 and 17, 1908.

Office of the Association:

Room 501, International Trust Building, 45 Milk Street,
Corner of Devonshire St., Boston, Mass.

1908



THE GIFT OF

Association

TS
1550
.N2

The National Association of Cotton Manufacturers.

Proposal for

.....

Membership of

.....

Application Received

.....190 .

NOTICE TO MEMBERS.

To make The National Association of Cotton Manufacturers the representative body which its name implies and to broaden the organization as far as possible, it must include more of those who are eligible for membership.

It has been found that many who were eligible and desired to join had not done so because not invited. It is hoped that every member will present the matter to eligible non-members among his associates. The accompanying blank proposition for membership can be detached from the cover at the row of perforations.

The National Association of Cotton Manufacturers.

Proposal for

.....

Membership of

.....

Application Received

.....190 .

Action by Board of Government,.....favorable.

.....190 .

Voted by the Association,.....elected.

.....190 .

The National Association of Cotton Manufacturers

SUCCESSOR TO

New England Cotton Manufacturers' Association

Room 501, International Trust Building,

45 MILK STREET,

BOSTON, MASS.

PROPOSAL FOR MEMBERSHIP.

(When filled out, to be mailed at any time to the Secretary, P. O. Box 3672, Boston, Mass., for action by the Board of Government, at least one week before a meeting of the Association.)

Mr. .....
State first name as well as surname.

Position, ...

Business Connection, ...
Name of corporation or firm.

P. O. Address, ...
Number. Street.

.....
City or town. State.

is proposed for ..... *membership in* THE NATIONAL ASSOCIATION
active or associate

OF COTTON MANUFACTURERS *by* .....
signature of member proposing candidate.

a member of the Association.

The undersigned certifies that the above statements are correct, and agrees that, if elected to the Association, he will be governed by its rules as long as his connection with it shall continue.

Date, ... 190 .

.....
signature of candidate.

REMARKS: It is desired that the proposer will supply such additional information as will aid in determining the eligibility of the applicant.

.....

.....

.....

.....

.....

TRANSACTIONS

—OF—

The National Association of Cotton Manufacturers.

SUCCESSOR TO

New England Cotton Manufacturers' Association,

ORGANIZED AS THE HAMPDEN COUNTY COTTON SPINNERS' ASSOCIATION.

Founded 1854. **Incorporated Dec. 1, 1894.**

NO. 84.

ANNUAL MEETING.

Held in Huntington Hall, Massachusetts Institute of Technology, 491 Boylston St., Boston, Mass.

APRIL 16 and 17, 1908.

Office of the Association:

Room 501, International Trust Building, 45 Milk Street, Corner of Devonshire St., Boston, Mass.

1908

ENTERED ACCORDING TO ACT OF CONGRESS
IN THE YEAR 1908
BY THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS,
IN THE OFFICE OF THE LIBRARIAN OF CONGRESS
AT WASHINGTON.

By vote of the Board of Government, the price of the *Transactions* is $5.00 per copy to non-members. The price of this issue and the one previous is $1.00 each to members, and the prices of copies previous to Volume 61, is 50 cents to members, but each member is entitled to a copy as a part of the privilege of membership.

CHARTER.

No. 6091.

Commonwealth of Massachusetts

BE IT KNOWN, That whereas, EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN have associated themselves with the intention of forming a corporation under the name of the NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION, for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry, promoting social intercourse among its members; and establishing and maintaining a library of works on textiles in the city of Boston, and have complied with the provisions of the Statutes of this Commonwealth in such case made and provided, as appears from the certificate of the President, Treasurer and Directors of said corporation, duly approved by the Commissioner of Corporations, and recorded in this office.

Now, Therefore, I, WILLIAM M. OLIN, Secretary of the Commonwealth of Massachusetts, do hereby certify that said EDWARD W. THOMAS, C. J. H. WOODBURY, WILLIAM J. KENT, F. M. MESSENGER, HARRY T. WHITIN, ARTHUR H. LOWE, ALBERT F. KNIGHT, ALFRED M. GOODALE, FRED C. MCDUFFIE and GEORGE W. BEAN, their associates and successors, are legally organized and established as and are hereby made an existing corporation under the name of the

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

with the powers, rights and privileges, and subject to the limitations, duties and restrictions which by law appertain thereto.

Seal of the Commonwealth of Massachusetts.

Witness my official signature hereunto subscribed, and the seal of the Commonwealth of Massachusetts hereunto affixed this first day of December, in the year of our Lord one thousand eight hundred and ninety-four.

WILLIAM M. OLIN,

Secretary of the Commonwealth.

157084

Commonwealth of Massachusetts.

(Acts of 1895, Chap. 163.)

AN ACT TO AUTHORIZE THE NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION TO HOLD ITS MEETINGS WITHOUT THE COMMONWEALTH.

Be it enacted, etc., as follows:

SECTION 1. The New England Cotton Manufacturers' Association is hereby authorized to hold its meetings in any state or territory of the United States and in the District of Columbia; provided, however, that its annual meeting shall be held in this Commonwealth at least once in five years.

SECT. 2. This act shall take effect upon its passage. [Approved March 23, 1895.]

No. 252.

Commonwealth of Massachusetts.

BE IT KNOWN that whereas

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION,

a corporation organized under the laws of this Commonwealth and subject to the provisions of chapter one hundred and twenty-five of the Revised Laws has complied with the provisions of chapter one hundred and nine of the Revised Laws, as appears from the certified copy of the order of the Commissioner of Corporations, authorizing said corporation to change its name and adopt the name of

THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS,

and the certificate of the Vice-President and Acting President, Treasurer and Directors of said corporation duly filed in this office pursuant to the provisions of section ten of the aforesaid chapter one hundred and nine of the Revised Laws.

NOW THEREFORE, I, William M. Olin, Secretary of the Commonwealth of Massachusetts, DO HEREBY CERTIFY, that the name which said corporation shall bear is

THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS,

which shall hereafter be its legal name.

Seal of the Commonwealth of Massachusetts.

WITNESS my official signature hereunto subscribed, and the Great Seal of the Commonwealth of Massachusetts hereunto affixed this twenty-fifth day of June in the year of our Lord one thousand nine hundred and six.

WM. M. OLIN,
Secretary of the Commonwealth.

THE

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.

SUCCESSOR TO

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

FOUNDED 1854.

INCORPORATED DECEMBER 1, 1894.

CONSTITUTION AND BY-LAWS.

ACTIVE MEMBERS.

ARTICLE 1. Any person who is actively engaged as President, Treasurer, Agent, Superintendent or Manager in the manufacture, printing or finishing of cottons shall be eligible for active membership.

ELECTION OF MEMBERS.

ARTICLE 2. All nominations for membership shall be made in writing, at least one week before the date of any regular meeting, and shall be considered by the Board of Government, and reported to the meeting, favorably or adversely, for the action of the Association. *Provided*, that in case the Board shall decide to report adversely upon any nomination, the member who shall have made it shall be informed of the intention so to report, in order that he may have an opportunity to withdraw the name. Upon such report active members may be admitted, if they obtain a majority of votes of the members present and voting therefor, by acceptance in writing, and paying an admission fee of ten dollars, and maintaining their membership by the payment of an annual assessment not exceeding ten dollars.* Any member failing to pay two successive assessments shall cease to be a member at the end of six months from the date when such second assessment shall become due. Any member may withdraw from the Association upon payment of all arrearages, first giving notice of his intention so to do, in writing, to the Secretary, and the Board of Government may

* This assessment has never exceeded five dollars for active members and ten dollars for associate members.

accept such resignation; and any member may be expelled for cause, at any regular meeting, two-thirds of the members present voting therefor.

ASSOCIATE MEMBERS.

ARTICLE 3. Persons engaged in the manufacture of cotton or cotton fabrics, or the manufacture of textile machinery, or industries kindred to the cotton manufacture, may become associate members of the Association. The methods of application, nomination, election and withdrawal from the Association being under the same conditions as those provided for active members in Article 2 excepting that this class of membership does not carry with it the privilege of voting or speaking, except by permission from the Board of Government or a vote of the Association to allow permission.

The initiation fee for associate members shall be twenty-five dollars, and the annual assessment shall be double the sum annually voted for active members.

Associate members may be expelled by a majority vote of the Board of Government.

HONORARY MEMBERS.

ARTICLE 4. Honorary members may be elected, when recommended by the Board of Government, at any regular meeting of the Association, who shall be enrolled as such, and shall be entitled to attend the meetings of the Association and participate in its proceedings, without the right to vote. They shall not be subject to payment of admission fees or assessments. No person actively engaged in cotton manufacture shall be eligible to honorary membership.

LIFE MEMBERS.

ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

ARTICLE 6. It shall be the duty of all members of the Association to make returns to the Secretary of such statistics as may be called for by him, under the direction of any committee duly appointed for the collection of statistics, when not incompatible with private interests.

OFFICERS.

ARTICLE 7. The officers of this Association shall be a President, two Vice-Presidents, nine Directors, a Treasurer, Secretary, and Auditor of Accounts.

ELECTION OF OFFICERS.

ARTICLE 8. At each annual meeting there shall be chosen by ballot a President, two Vice-Presidents and three Directors; the President and Vice-Presidents to serve one year, and the three Directors shall be chosen for terms of three years, unless sooner removed as hereinafter provided.

DUTIES OF OFFICERS.

ARTICLE 9. The President, or in his absence the senior Vice-President present, shall preside at all meetings of the Association and of the Board of Government. All officers shall hold their respective offices until their successors shall be chosen and accept their positions.

ARTICLE 10. The President, Vice-Presidents and Directors shall constitute a Board of Government, and have under their care and direction all matters pertaining to the management of the Association; and five of their number shall constitute a quorum for the transaction of business. Meetings of the board may be called by the President, at such time and place as he may deem expedient, giving each member a written or printed notice of the same at least five days before the day of meeting. At their first meeting the board shall elect a Treasurer, Secretary, and Auditor of Accounts for the year ensuing, and fix the amount of compensation of the Secretary. All vacancies in their board occasioned by death or resignation or removal, shall be filled by the board; and the persons so elected shall hold their offices until the next annual meeting except as hereinafter provided. The board may, from time to time, as they shall deem expedient, appoint committees, from among their own board or from the members at large, to collect statistical information, examine new inventions or processes in manufacturing goods, as also to prepare essays on subjects of interest to the Association.

ARTICLE 11. The Treasurer shall keep a book in which all receipts and payments of money shall be entered, collect all moneys due the Association, and disburse the same upon the written order of the Board of Government. At the annual meeting in each year he shall make an exhibit of his accounts, or oftener if the Board of Government require it. He shall notify the members of assessments voted, and cause them to be collected in a reasonable time.

ARTICLE 12. The Secretary shall attend all meetings of the Association and of the Board of Government, and keep accurate records of their doings. In the absence of the Secretary at any meeting, a Secretary *pro tem.* may be appointed by the presiding officer, who shall be sworn to do all things, while in office, required of the Secretary.

ARTICLE 13. The Auditor shall examine the accounts of the Treasurer annually, and report at each meeting the state of the finances.

ARTICLE 14. Any officer who shall unreasonably absent himself from three consecutive meetings of the Board of Government of which he is a member, or shall otherwise neglect or refuse to perform the duties of his office, may be removed from office at any regular meeting of the Board of Government by a vote of a majority of the members present and voting thereon, a notice of such proposed action to be sent to him by mail at least one week previous to the meeting.

MEETINGS.

ARTICLE 15. The annual meeting of the members of the Association shall be held on the last Wednesday of April, or at such other time, and at such hour and place as the Board of Government may appoint. There shall also be a semi-annual meeting of the Association on the last Wednesday of October, in each and every year, or at such other time, and at such place and hour as the Board of Government may appoint.

Special meetings may be called by the Board of Government whenever they deem it expedient, or upon the written application of any ten members, made to the Secretary.

ARTICLE 16. All meetings of the members of the Association shall be in pursuance of a written or printed notice, addressed to each member, with the name of the President or Secretary attached thereto, and deposited in the Post Office ten days at least before the day of meeting, specifying the time and place of meeting; and at all such meet-

ings fifteen members shall constitute a quorum for the transaction of business.

ARTICLE 17. Amendments to the By-Laws may be made at any stated meeting of the Association by a two-thirds vote; *provided*, notice of such proposed amendment be given in writing at a previous meeting, and also notice be given to each member by the Secretary, of the pendency of such amendment, ten days at least before any such meeting.

AMENDMENT TO CONSTITUTION AND BY-LAWS.

The following amendment was adopted at the seventy-fifth meeting of the Association, September 30, 1903:

"ARTICLE 5. Any active or associate member by the single payment of one hundred dollars shall be exempt from all future payments for dues and shall become a life member having all the privileges of active members.

All moneys thus paid shall be invested as a permanent fund by the Treasurer acting under the direction of the Board of Government, of which the income only shall be subject to appropriation for current expenses.

All articles of the Constitution and By-Laws, beginning with Article 5, shall be increased in number to the next cardinal number."

BOARD OF GOVERNMENT.

1908.

PRESIDENT.

CHARLES T. PLUNKETT, . . . ADAMS, MASS.

VICE-PRESIDENTS.

GEORGE OTIS DRAPER, . . . HOPEDALE, MASS.
FRANKLIN W. HOBBS, . . . BOSTON, MASS.

DIRECTORS.

ROBERT BEATTY, ... PHILADELPHIA, PA.
FREDERICK A. FLATHER, . . LOWELL, MASS.
GEORGE P. GRANT, JR., . . . FITCHBURG, MASS.
EDWIN FARNHAM GREENE, . . BOSTON, MASS.
DAVID S. JOHNSTON, . . . COHOES, N. Y.
JOHN W. KNOWLES, ... NEW BEDFORD, MASS.
WILLIAM H. LOFTUS, ... NEWARK, N. J.
HENRY F. MANSFIELD, . . . UTICA, N. Y.
JOSEPH MERRIAM, ... MIDDLETOWN, CONN.

AUDITOR.

C. E. ROBERTS, ... BOSTON, MASS.

SECRETARY AND TREASURER.

C. J. H. WOODBURY, P. O. Box 3672, BOSTON, MASS.

OFFICE OF THE ASSOCIATION:

ROOM 501, INTERNATIONAL TRUST BUILDING, 45 MILK STREET, CORNER OF DEVONSHIRE STREET, BOSTON, MASS.

OFFICERS OF THE ASSOCIATION,

FROM THE FIRST ORGANIZATION.

PRESIDENTS.

Ezekiel A. Straw,	1865–78	Arthur H. Lowe,	1896–97
Amos D. Lockwood,	1878–80	Russell W. Eaton,	1897–98
John Kilburn,	1880–83	Stephen A. Knight,	1898–99
William C. Lovering,	1883–85	Frederick E. Clarke,	1899–99
Richard Garsed,	1885–86	David M. Thompson,	1900–01
Joseph S. Ludlam,	1886–88	Charles H. Fish,	1901–03
Henry F. Lippitt,	1888–89	Herbert E. Walmsley,	1903–05
Walter E. Parker,	1889–92	James R. MacColl	1905–07
Robert McArthur,	1892–94	William D. Hartshorne,	1907–08
Edward W. Thomas,	1894–95	Charles T. Plunkett,	1908–
Alfred M. Goodale,	1895–96		

VICE-PRESIDENTS.

Amos D. Lockwood,	1865–77	Alfred M. Goodale,	1893-95
William A. Burke,	1865–73	William J. Kent,	1894–97
John C. Palfrey,	1873–76	Fred. C. McDuffie,	1895–00
Edward Atkinson,	1876–78	Henry T. Whitin,	1897–00
A. G. Cumnock,	1877–80	Charles H. Richardson,	1900–01
Charles Nourse,	1878–81	George H. Hills,	1900–02
William F. Goulding,	1880–83	Herbert E. Walmsley,	1901–03
Richard Garsed,	1881–85	Alfred E. Adams,	1902–03
Joseph S. Ludlam,	1883–86	James R. MacColl,	1903–05
Walter E. Parker,	1885–89	Wm. D. Hartshorne,	1903–07
Richard B. Borden,	1886–88	George A. Ayer,	1905–07
Arnold B. Sanford,	1888–91	Charles T. Plunkett,	1907–08
Robert McArthur,	1889–92	George Otis Draper,	1907–
Simeon B. Chase,	1891–93	Franklin W. Hobbs,	1908–
Edward W. Thomas,	1892–94		

DIRECTORS.

Jones S. Davis,	1865–69	Edward W. Thomas,	1888–92
Charles Nourse,	1865–78	William W. Whitin,	1888–93
Phinehas Adams,	1865–74	Robert R. Smith,	1889–92
William P. Haines,	1865–69	Alfred M. Goodale,	1890–93
Thomas J. Borden,	1865–78	William J. Kent,	1891–94
Daniel D. Crombie,	1865–68	Herman F. Straw,	1891–93
A. M. Wade,	1868–69	Fred C. McDuffie,	1892–95
David J. Johnston,	1869–70	George W. Bean,	1892–95
Frederick E. Clarke,	1869–75	Frank M. Messenger,	1893–95
A. G. Cumnock,	1869–77	Albert F. Knight,	1893–99
Cyrus I. Barker,	1875–80	Arthur H. Lowe,	1894–96
Hervey Kent,	1877–81	Henry T. Whitin,	1894–97
David J. Johnston,	1878–82	Herbert L. Pratt,	1895–98
Walter Paine, 3d,	1878–80	Stephen A. Knight,	1895–98
Chas. L. Lovering,	1878–83	John Eccles,	1895–99
Richard Garsed,	1880–81	Russell W. Eaton,	1896–97
William H. Jennings,	1880–83	Charles H. Richardson,	1897–00
Chas. D. McDuffie,	1881–83	George H. Hills,	1897–00
Walter E. Parker,	1881–85	John T. Meats,	1898–01
John W. Danielson,	1881–85	Alfred E. Adams,	1899–02
William E. Barrows,	1882–83	A. Tenny White,	1899–02
Rufus A. Maxfield,	1883–86	Charles H. Fish,	1900–01
George W. Weeks,	1883–86	Herbert E. Walmsley,	1900–01
Henry S. Howe,	1883–87	Wm. D. Hartshorne,	1901–03
Richard B. Borden,	1883–86	James R. MacColl,	1901–03
O. S. Brown,	1885–91	George F. Whitten,	1898–04
Henry F. Lippitt,	1885–88	W. B. Smith Whaley,	1901–04
Wilbur A. Stiles,	1886–88	James R. Montgomery,	1902–05
Robert McArthur,	1886–89	Wm. D. Pennell,	1902–05
Stephen N. Bourne,	1886–91	George A. Ayer,	1904–05
John Kilburn,	1870–80	Philip A. Mathewson,	1903–06
William P. Haines,	1874–78	Christopher P. Brooks,	1904–07
S. S. Spencer,	1887–90	Charles T. Plunkett,	1905–07

DIRECTORS.—Continued

Roscoe S. Milliken,	1905–08	Henry F. Mansfield,	1906–
Franklin W. Hobbs,	1906–08	Frederick A. Flather,	1907–
George Otis Draper,	1906–07	Edwin Farnum Greene,	1907–
George P. Grant, Jr.,	1903–	John W. Knowles,	1907–
William H. Loftus,	1905–	David S. Johnston,	1908–
Robert Beatty,	1906–	Joseph Merriam,	1908–

AUDITORS.

Benjamin Saunders,	1865–71	J. Herbert Sawyer,	1882–00
John C. Palfrey,	1871–73	C. E. Roberts,	1900–
Henry D. Sullivan,	1873–82		

SECRETARY AND TREASURER.

Ambrose Eastman,	1865–94	C. J. H. Woodbury,	1894–

MEMBERS OF THE ASSOCIATION.

May 1, 1908.

Members of the Association are respectfully requested to scrutinize the following list, and advise the Secretary, P. O. Box 3672, Boston, Mass., of change in address, or any error in regard to their names.

As a number of members rejoined the Association after severing their first membership, the date of their earliest election is given.

HONORARY MEMBERS.

GEORGE ARMS	Grand Hotel, New York City	Oct. 16, 1872.
HENRY SMITH PRITCHETT, LL.D.,	Care Carnegie Foundation, 576 Fifth Avenue, New York City,	Sept. 26, 1901.
EDWARD C. STOKES	Trenton, N. J.,	Sept. 21, 1905.
FRANKLIN P. STOY	817 Pacific Ave., Atlantic City, N. J.	Sept. 21, 1905.

LIFE MEMBERS.*

John Ormsbee Ames	Agt. & Sec'y Fletcher Mfg. Co.,	Sept. 21, 1905.
	47 Charles St., Providence, R. I.,	Sept. 21, 1905.
William Ames	Treas. Fletcher Mfg. Co., P. O. Box 83,	Apr. 30, 1879.
	47 Charles St., Providence, R. I.,	Sept. 21, 1905.
Augustus T. Clark	Treas. and Managing Director, American Circular	Sept. 21, 1905.
	Loom Co., 45 Milk St., Room 804, Boston, Mass.	Sept. 21, 1905.
Daniel J. Danker	Danker & Marston, 247 Atlantic Ave., Boston, Mass.	Apr. 28, 1904.
		Apr. 25, 1907.
Charles H. Fish	Agt. Cocheco Mfg. Co., Dover, N. H.	Apr. 27, 1887.
		Apr. 28, 1904.
Frederick A. Flather	Treas. Boott Mills, 79 Milk St., Boston, Mass.	Apr. 29, 1891.
		Apr. 17, 1908.
William D. Hartshorne	Agt. Arlington Mills, Lawrence, Mass,	Apr. 27, 1899.
		Apr. 26, 1906.

* The first date is that of the original election to the Association and the second date that of Life Membership.

James R. MacColl	Treas. Lorraine Mfg. Co.	Pawtucket, R. I.,	Apr. 24, 1895. Sept. 21, 1905.
John P. Marston	Danker & Marston, 247 Atlantic Ave.,	Boston, Mass.	Apr. 28, 1904. Apr. 25, 1907.
John R. Mitchell	Prest. Mitchell-Bissell Co. 227 Fulton St.,	New York City	Oct. 18, 1900. Apr. 27, 1905.
Robert W. Neff	Chemical Mfr.,	22 India Sq., Boston, Mass.,	Apr. 24, 1902. Apr. 28, 1904.
Walter E. Parker	Agt. Pacific Mills	217 Haverhill St., Lawrence, Mass.	Apr. 25, 1877. Apr. 27, 1905.
George I. Rockwood	Mech. Eng.	62 Summer St., Worcester, Mass.	Apr. 25, 1901. Apr. 25, 1901.
Robert Schaellibaum	Prest. Robert Schaellibaum Co.	Providence, R. I.	Sept. 22, 1904. Sept. 22, 1904.
C. J. H. Woodbury	Secretary and Treasurer,	51 Baltimore St., Lynn, Mass.,	Oct. 29, 1879. Apr. 28, 1904.

ACTIVE MEMBERS.

James H. Abercrombie	Mech. Supt., Clark Thread Co.	Newark, N. J.	Apr. 25, 1907.
Alfred E. Adams	Supt. Whitinsville Cotton Mills Agt. Linwood Mills	Whitinsville, Mass.	Apr. 27, 1887.
Henry Shaw Adams	Pur. Agt., Union Buffalo Mills Co.	Union S. C.	Oct. 4, 1907.
Ivers S. Adams	Supt. American Net and Twine Co.	East Cambridge, Mass.	Sept. 22, 1904.
Robert Franklin Adams,	Treas. The Adams Mfg. Co.	106 Grand St., New York, N. Y.	Sept. 22, 1904.
William P. Adams		Pittsfield, N. H.,	Apr. 28, 1904.
James W. Ahmuty	Supt. Atlantic Cotton Mills,	Lawrence, Mass.,	Apr. 28, 1904.
Joseph D. Aiken	Asst. Supt. Ponemah Mills	Taftville, Conn.	Oct. 28, 1891.
F. S. Akin	Supt. Cornell Mills	Fall River, Mass.	Sept. 27, 1894.
Charles T. Aldrich	Treas. Aldrich Mfg. Co.	37 Weybosset St., P. O. Box 34, Providence, R. I.	Apr. 28, 1886.
Bradley C. Algeo	Asst. Director Philadelphia Textile School,	320 South Broad St., Philadelphia, Pa.,	Sept. 21, 1905.
G. Bion Allen	Sec'y Pawtucket Branch J. & P. Coats, Ltd.	117 Mulberry St., Pawtucket, R. I.	Apr. 25, 1907.
John W. Allis	Vice-Prest. and Agt. Utica Knitting Co.,	Utica, N. Y.	Apr. 27, 1905.
George E. Ames	Mech. Supt. Lawrence Mfg. Co.	Lowell, Mass.	Apr. 24, 1895.
Charles B. Amory	Treas. Hamilton Mfg. Co., Room 48	70 Kilby St., Boston, Mass.	Apr. 25, 1894.
Frederic Amory	Treas. Nashua Mfg. Co. and Treas. Jackson Mfg. Co.	82 Devonshire St., P. O. Box 1302, Boston, Mass.	Apr. 27, 1899.
Joshua D. Armitage	Marsdon Street Mill	247 Haverhill St., Lawrence, Mass.	Apr. 26, 1906.
Thomas Armstrong	Supt. No. Pownal Mfg. Co.	No. Pownal, Vt.	Oct. 28, 1897.

Charles H. Arnold . . Supt. Grosvenor Dale Co. . . . . Grosvenor Dale, Conn. Apr. 17, 1908.
William F. Arthur . . Supt. Nashua Mfg. Co. . . . . Nashua, N. H. . . . Apr. 23, 1903.
Abel T. Atherton . . . Machine Maker . . . . . Longmeadow, R. I. . Oct. 16, 1872.
E. W. Atkinson . . . . Stoddard, Haserick, Richards & Co. . . . . .
. . . . . 152 Congress St., Boston, Mass. . . . Oct. 27, 1886.
Clinton W. Atwood . . Sec'y Williamsville Mfg. Co. . . . . Killingly, Conn. . . Apr. 17, 1908.
H. C. Atwood . . . . Treas. Williamsville Mfg. Co. . . . Killingly, Conn. . . Apr. 29, 1885.
James A. Atwood . . . Agt. Wauregan Co. and Agt. Quinebaug Co. . . . . .
. . . . . Wauregan, Conn. . . Oct. 28, 1891.
John Walter Atwood . Supt. Wauregan Co. . . . . Wauregan, Conn. . . Oct. 25, 1895.
W. E. Atwood . . . . Prest. Williamsville Manufg. Co. . . Killingly, Conn. . . . Sept. 27, 1894.
Louis A. Aumann . . . Agt. Dwight Mfg. Co., ... Chicopee, Mass. . . Apr. 25, 1907.
George A. Ayer . . . Supt. West Boylston Co. . . . . Easthampton, Mass. . Apr. 24, 1895.
Nathaniel F. Ayer . . . Asst. Treas. Farwell Bleachery, Asst. Treas. Farwell Mills
. . . . . 70 Kilby St., Boston, Mass. . . . Apr. 25, 1901.

J. W. Bailey . . . . . Principal, The Bradford Durfee Textile School . . . .
. . . . . Fall River, Mass. . . Apr. 23, 1903.
Dickerson G. Baker . . V. P. Samuel M. Green Co. Inc. . . Holyoke, Mass. . . .
. . . . . Mail Address, 17 North St., Willimantic. Conn. . Oct. 18, 1900.
Edwin H. Baker . . . Bliss, Fabyan & Co., P. O. Box 2899 . . . . . .
. . . . . 117 Duane St., New York, N. Y., Apr. 24, 1878.
Wallace L. Ball . . . Agt. Consolidated Cotton Duck Company, Columbia Mills Co.
. . . . . Columbia, S. C. . . Apr. 26, 1906.
Joseph W. Ballard . . Supt. Griswoldville Mfg. Co. . . . . Griswoldville, Mass., Apr. 26, 1906.
Edward R. Ballou . . . Treas. Ballou Yarn Co., ...
. . . . . 189 Charles St., Providence, R. I. . . Apr. 25, 1894.
Frederick D. Ballou . . Supt. W. A. Slater Mills . . . . . Jewett City, Conn. . Apr. 23, 1903.
V. T. Barber . . . . . Supt. Conanicut Mills, ... Fall River, Mass. . . Oct. 2, 1902.
J. E. Barbour . . . . Prest. Barbour Flax Spinning Co. . . . . .
. . . . . 418 Grand St., Paterson, N. J. . . . Apr. 28, 1904.
Louis B. Barker . . . Agt. United States Cotton Co. . . . Central Falls, R. I. . Apr. 27, 1899.
J. R. Barlow . . . . . Barlow & Jones, Ltd., Portland St., . Manchester, Eng. . . Oct. 4, 1907.
Harold C. Barnefield . Treas. Hays Textile Co. . . . . Pawtucket, R. I. . . Apr. 26, 1906.
Lewis E. Barnes . . . . . Methuen, Mass. . . . Oct. 25, 1895.
Thomas Barrett, Jr. . . Prest. Langley and Prest. Aiken Mills, ...
. . . . . Augusta, Ga. . . . . Apr. 26, 1900.
Edward E. Bartlett . . Supt. Parker Mills, No. 2 . . . . . Warren, R. I. . . . Sept. 22, 1904.
Edwin N. Bartlett . . . Supt. Edwin Bartlett Co., ... North Oxford, Mass. . Apr. 29, 1891.
Daniel Moore Bates . Asst. Supt. Joseph Bancroft & Sons Co., ...
. . . . . Rockford, Wilmington, Del. . . Apr. 27, 1898.
William M. Batt . . . The Davol Mills . . . P. O. Box 73, Fall River, Mass. . . Apr. 26, 1906.
Joseph P. Battles . . . Treas. The Textile Mach. Specialty Co., Lawrence, Mass. .
. . . . . Res. 5 Earl St., Malden, Mass. . . . Oct. 25, 1895.
Edward C. Beach . . Mgr. Mobile Cotton Mills . . . . . .
. . . . . P. O. Box 314, Mobile, Ala. . . . . Oct. 5, 1899.

C. Enos Bean . . . . Sec'y & Mgr. Tennile Yarn Mills . . Tennile, Ga. . . . . Apr. 24, 1902.
George W. Bean . . . Agt. Androscoggin Mills . . . . . Lewiston, Me. . . . Apr. 17, 1872.
Robert Beatty . . . . Robert Beatty & Co. . . . . Coral and Adams Sts., Philadelphia, Pa. . . Oct. 28, 1897.
John W. Bell . . . . . Asst. Treas. and Gen. Mgr. Smith & Dove Mfg. Co. . . . . Andover, Mass. . . . Oct. 28, 1897.
Albert Farwell Bemis . Prest. Jackson Fibre Co., (Jackson, Tenn.) . . . . . P. O. Box 5173, 89 State St., Boston, Mass. . . . Apr. 23, 1903.
Orin F. Bennett, . . . Supt. Naumkeag Steam Cotton Co. . . . . 19½ Roslyn St., Salem, Mass. . . . . Sept. 13, 1906.
A. C. Bent . . . . . Agt. Safety Seamless Pocket Co. . . Taunton, Mass. . . . Oct. 28, 1897.
Lewis E. Bentley . . . Agt. Taber Mill . . . 252 Main St., Fairhaven, Mass. . . Apr. 17, 1908.
William H. Bilbrough . Sec'y and Treas. Elmira Knitting Mills and Mgr. Conewawah Spinning Co., Elmira, N. Y. . . . . Apr. 24, 1902.
R. Bloss Billings . . . Treas. and Mgr. Utica Dyeing Co. . Utica, N. Y. . . . . Apr. 25, 1907.
John H. Binns . . . . Supt. Dyeing & Finishing, Arlington Mills, ... Thornfield, Methuen, Mass. . . Apr. 26, 1906.
John B. Bird . . . . . Engineer Joseph Bancroft & Sons Co. Wilmington, Del. . Apr. 26, 1906.
Louis W. Bishop . . . Prest. and Treas. Blackstone Webbing Co. . . . . Pawtucket, R. I. . . Apr. 25, 1907.
Robert Bishop . . . . Robert Bishop Mfg. Co. . . . . 157 West 6th St., South Boston, Mass., Apr. 26, 1906.
W. N. Blackstone . . { Treas. Attawaugan Co. / Treas Totokett Mills Co. } . . . Norwich, Conn. . . . Apr. 29, 1896.
Wm. Washington Blades, Gen. Supt. Lorraine Mfg. Co. . . . . 135 Mineral Spring Ave., Pawtucket, R. I. . . Oct. 25, 1893.
Charles Ray Blake . . Asst. Supt. Tremont and Suffolk Mills . . . . . 141 Cabot St., Lowell, Mass. . . . Sept. 21, 1905.
William S. Blakeley . . Prest. The Arasapha Co. . . . . Chester, Pa. . . . . Sept. 21, 1905.
Edward R. Blanchard . Mgr. Glenlyon Dye Works, Phillipsdale Branch . . . . . 247 Wayland Ave., Providence, R. I. . . Apr. 26, 1906.
Robert C. Blood . . . John Blood & Co. . . . . 7th and Somerset Sts., Philadelphia, Pa. . . Apr. 26, 1906.
Harry H. Blunt . . . Treas. Wonolancet Company . . . Nashua, N. H. . . . Apr. 25, 1907.
T. Ashby Blythe . . . Prest. Ashby Cotton Mills, ... 114 Chestnut St., Philadelphia, Pa. . . Oct. 28, 1897.
John P. Bodge . . . . Treas. Arkwright Mills . . . . . Fall River, Mass. . . Oct. 28, 1897.
J. C. Bolon . . . . . Care of Hudson Converting Co. . . Hudson, Mass. . . . Apr. 25, 1907.
J. B. Bolton . . . . . Arlington Mills . . . . . 222 Broadway, Methuen Sta., Lawrence, Mass. . . Apr. 26, 1906.
George H. Booth . . . Agt. Gosnold Mill, ... New Bedford, Mass. . Apr. 25, 1907.
Joseph W. Booth . . . Asst. Supt. Atlantic Mills . . . . . Providence, R. I. . . Apr. 25, 1907.
Charles N. Borden . . Treas. Richard Borden Mfg. Co. . . Fall River, Mass. . . Apr. 25, 1907.
Jefferson Borden, Jr. . Supt. Fall River Bleachery Co. . . . Fall River, Mass. . . Apr. 27, 1899.
Nathaniel B. Borden . Treas. Barnard Mfg. Co. . . . . Fall River, Mass. . . Oct. 15, 1873.
Norman E. Borden . . Sec. Lowell Weaving Co. . . . . Lowell, Mass. . . . Apr. 26, 1906.
Raymond D. Borden . Cotton and Cotton Yarns . . . . . Fall River, Mass. . . Sept. 22, 1904.

E. S. Boss . . . . . Agt. American Thread Co. . . . . Willimantic, Conn. . Oct. 29, 1879.
A. E. Bosworth . . . . Supt. Bernon Mills . . . . . Georgiaville, R. I. . . Oct. 2, 1902.
Henry Deane Bourne . Treas. Hooksett Mfg. Co., ... 1741 Elm St. Manchester, N. H. . Oct. 18, 1900.
Stephen N. Bourne . . Agt. Dundee Mills, Hooksett . . . . . 2195 Elm St., Manchester, N. H. . Oct. 27, 1886.
Frank A. Bowen . . . Supt. Appleton Co. . . . . Lowell, Mass. . . . Apr. 28, 1897.
William V. Boyd . . . Asst. to Mgr. Canadian Col'd Cotton Mills Co. . . . . P. O. Box 76, Cornwall, Ont., Canada, Apr. 26, 1906.
Robert William Boys . Supt. Newmarket Mfg.Co., P.O. Box 75, Newmarket, N. H. . Oct. 4, 1907.
S. Parker Bremer . . . Dir. and Sel. Agt. Parker, Wilder & Co., Monadnock Mills . . . . . 4 Winthrop Sq., Boston, Mass. . . . Oct. 2, 1902.
Ernest Bridge . . . . Supt. Jas. Chadwick & Bro. Ltd. . . Jersey City, N. J. . . Apr. 24, 1895.
Joseph Brierley . . . . Supt. W. C. Plunkett & Sons Warp Mill, ... Forest Park, Adams, Mass. . . . Sept. 21, 1905.
George T. Briggs . . . Prest. and Gen. Mgr. The Briggs Mfg. Co. . . . . Voluntown, Conn. . Apr. 24, 1902.
Jas. T. Broadbent . . . Instr. The Carding and Spinning, The Bradford Durfee . . . . . Textile School, Fall River, Mass. . . Apr. 28, 1904.
Edward Bromley . . . Member of Firm of John Bromley & Sons . . . . . Lehigh Ave. & Front St., Philadelphia, Pa. . . Apr. 25, 1907.
Joseph H. Bromley . . Manufacturer of Lace Curtains, ... Fourth and Lehigh Ave., Philadelphia, Pa. . . Sept. 21, 1905.
Christopher P. Brooks . . . . . New Bedford, Mass. Apr. 28, 1897.
Henry R. Brown . . . Supt. Hope Co. Phenix Mill, ... P. O. Box 56, Phenix, R. I. . . . . Apr. 28, 1897.
Isaac A. Brown . . . . Treas. Narragansett Mills, ... P. O. Box 324, Fall River, Mass. . . Sept. 29, 1898.
Thomas J. Brown . . . George Brown's Sons . . . . . Mt. Joy, Pa. . . . . Oct. 28, 1897.
E. C. Bucklin . . . . Treas. Interlaken Mills . . . . . 38 Butler Exchange, P. O. Box 289, Providence, R. I. . . Apr. 25, 1883.
Harris H. Bucklin . . Asst. Treas. Interlaken Mills . . . . . 381 Butler Exchange, Providence, R. I. . . Apr. 23, 1903.
E. R. Bullock, ... Mech. Eng., J. & P. Coats, Ltd., ... 38 Brook St., Pawtucket, R. I. . . Apr. 28, 1904.
Robert Burgess . . . . Treas. Burgess Mills . . . . . Pawtucket, R. I. . . Apr. 27, 1892.
Edward N. Burke . . . . . 216 Nesmith St., Lowell, Mass. . . . Apr. 28, 1880.
James A. Burke . . . Agt. Lyman Mills . . . . . Holyoke, Mass. . . . Apr. 17. 1908.
Alfred H. Burnham . . Mgr. Glasgow Mills, ... Orthodox and Horrocks Sts., Frankford, . . Philadelphia, Pa. . . Apr. 26, 1900.
Charles F. Burnham . . Treas. Crefeld Waste and Batting Co., ... and The L. A. Lockwood Co. . . . Saylesville, R. I. . . Sept. 21, 1905.
Hervey Burnham . . . Supt. Beaver Mills and Supt. Eclipse Mill, ... 234 East Main St., North Adams, Mass. . Apr. 27, 1899.
W. R. Burnham . . . . . 362 Main St., Norwich, Conn. . . . Apr. 29, 1885.
John L. Burton . . . . Supt. Bristol Mfg. Corp. . . . . New Bedford, Mass. . Apr. 23, 1903.

Obadiah Butler . . . . Supt. Taber Mills, Co. . . . . New Bedford, Mass. Sept 13, 1906.
Paul Butler . . . . . Prest. Whittier Mills, Chattahoochee, Ga. . . . . .
. . . . . Lowell, Mass. . . . Apr. 25, 1907.
Samuel T. Butterworth . Supt. Baltic Mills Co., P. O. Box 103, Baltic, Conn. . . . . Sept. 21, 1905.

William H. Cadwell . . Agt. The Jackson Mfg. Company, . Nashua, N. H. . . . Apr. 26, 1900.
John P. Campbell . . . Asst. Treas. New York Mills, New York Mills, ...
. . . . . Oneida County, N. Y. . Sept. 22, 1896.
Byron F. Card . . . . . Tallassee, Elmore County, Ala. . . Apr. 25, 1888.
Hamilton Carhartt . . Prest. Hamilton Carhartt Cotton Mills, Rock Hill, S. C. . . Apr. 25, 1907.
D. Allison Carrick . . Treas. Sycamore Mills, 65 Franklin St., Boston, Mass. . . . Apr. 25, 1907.
Stewart F. Carter . . . Tech. Chemist, Glenlyon Dye Works, Saylesville, R. I. . . Apr. 26, 1906.
Arnold B. Chace . . . Treas. Valley Falls Co. . . . . Albion, R. I. . . . . Apr. 26, 1906.
Benjamin C. Chace, Jr. . Supt. Samoset Co. . . . . Valley Falls, R. I. . . Sept. 21, 1905.
Malcolm G. Chace . . Prest. Naushon Mfg. Co. . . . . Valley Falls, R. I. . . Sept. 21, 1905.
Alfred M. Chadwick, . Asst. Agt. Tremont & Suffolk Mills, Lowell, Mass. . . . Apr. 28, 1904.
Charles B. Chase . . . Supt. Lincoln Mfg. Co. . . . . .
. . . . . P. O. Box 45, 120 Highland Ave., Fall River, Mass. . . Apr. 17, 1908.
Simeon B. Chase . . . . . Fall River, Mass. . . Apr. 21, 1875.
E. G. Chester . . . . Prop. E. G. Chester Hosiery Co. . . . . .
. . . . . Cedar and Huntingdon Sts., Philadelphia, Pa. . . Sept. 21, 1905.
Chas. E. Childs . . . . Treas. Hampton Co., Asst. Treas. West Boylston Co. . . .
. . . . . Northampton, Mass. . Oct. 1, 1903.
Clarence N. Childs . . Agt. Hamilton Mfg. Co., Jackson St., Lowell, Mass. . . . Apr. 24, 1895.
Elmer G. Childs . . . Agt. Boston Duck Co. . . . . Bondsville, Mass. . . Oct. 26, 1892.
Jno. H. C. Church . . . Treas. and Gen. Mgr. Monument Mills, Great Barrington Mass. Apr. 28, 1897.
Alfred L. Clark . . . . Supt. Greene & Daniels Mfg. Co. . . . . .
. . . . . 30 Orchard St., Pawtucket, R. I. . . Apr. 25, 1907.
Avery B. Clark, ... Supt. Merrimack Mfg. Co. . . . . Lowell, Mass. . . . Apr. 27, 1905.
Ernest E. Clark . . . Supt. Williamsville Mfg. Co. . . . . Killingly, Conn. . . Apr. 29, 1896.
William Clark . . . Agt. Wm. Clark Mills, American Thread Co. . . . . .
. . . . . Westerly, R. I. . . Sept. 21, 1905.
Carl Clauss . . . . . Prest. Baumwollspinnerei am Stadtbach, Augsburg, Germany . Oct. . 4, 1907.
E. N. Clemence . . . Cotton Manufacturer . . . . . Charlotte, N. C. . . . Apr. 28, 1897.
W. H. Cloher, Jr. . . . Prest. Utica Cotton Co., . Capron, Oneida Co., N. Y., . Sept. 22, 1896.
Alfred M. Coats . . . Gen. Mgr. J. & P. Coats, L't'd. . . . . .
. . . . . 13 Brown St., Providence, R. I. . . Sept. 21, 1905.
W. C. Cobb . . . . . Supt. Ware Shoals Mfg. Co. . . . . Ware Shoals, S. C. . Apr. 26, 1906.
James E. Coburn . . . Agt. Stark Mills . . . . . Manchester, N. H. . Oct. 4, 1907.
Josiah G. Coburn . . . . . 99 Washington St., Newton, Mass. . . . Apr. 20, 1865.
Charles E. Collins . . . Supt. Methuen Co. . . . . Methuen, Mass. . . . Apr. 17, 1908.
Charles H. Collins . . Supt. Berkeley Co. . . . . Ashton, R. I. . . . . Apr. 26, 1900.
John A. Collins . . . . Supt. American Linen Co. . . . . .
. . . . . 73 Cottage St., Fall River, Mass. . . Oct. 31, 1883.

Frank B. Comins . . . Treas. American Moistening Co. . . . . .
. . . . . 79 Milk St., Room 901, Boston, Mass. . . . . Oct. 28, 1891.
Caesar Cone . . . . . Prest. Proximity Mfg. Co. . . . . Greensboro, N. C. . . Apr. 26, 1900.
Thomas H. Conley . . Asst. Supt. Mohawk Valley Cotton Mills . . . . . .
. . . . . Utica, N. Y. . . . . Apr. 17, 1908.
William A. Congdon . Agt. Whitman Mills, 720 County St., New Bedford, Mass. Apr. 26, 1906.
John J. Connell . . . . Agt. Tremont & Suffolk Mills . . . Lowell, Mass. . . . Apr. 27, 1892.
Halsey Connett . . . . Supt. Clark Mile End Spool Cotton Co. East Newark, N. J. . Oct. 2, 1902.
G. Arthur Cook . . . . Sec'y West Boylston Mfg. Co. . . . Easthampton, Mass. . Apr. 25, 1907.
Reuben A. Cooke . . . Treas. Queen City Cotton Co. . . . . .
. . . . . Lake Side Ave., Burlington, Vt. . . . Sept. 13, 1906.
Robert A. Copeland . . Supt. Yarn Mills, Perry Knitting Co. . . . . .
. . . . . P. O. Box 4765, Perry, New York . . Apr. 26, 1906.
Peter H. Corr . . . . Treas. Greenwich Bleachery . . . . Taunton, Mass. . . . Apr. 24, 1895.
Frank H. Cotton . . . . . Fayetteville, N. C. . . Apr. 27, 1899.
Lyman M. Cousens, . . Prest. Dana Warp Mills, 164 Myrtle St., Portland, Me. . . Apr. 24, 1902.
Thomas D. Covel . . . Treas. The Covel and Osborne Co. . Fall River, Mass. . . Apr. 26, 1906.
Richard Cowell . . . . . 81 Mt. Pleasant St., New Bedford, Mass. . Apr. 24, 1902.
Amos Crankshaw . . . Supt. Cotton Yarn Dept., Lorraine Mfg. Co. . . . . .
. . . . . Pawtucket, R. I. . . Apr. 25, 1907.
L. B. Cranska . . . . Floyd Cranska Mills . . . . . Moosup, Conn. . . . Sept. 21, 1905.
William W. Crapo . . Prest. Wamsutta Mills . . . . . New Bedford, Mass. . Sept. 29, 1898.
Mark B. Creed . . . . Supt. 4, 5, & 8 Wamsutta Mills . . . New Bedford, Mass. . Oct. 1, 1903.
George Crompton . . . Supt. Middlesex Bleachery, ...
. . . . . 53 Bay State Ave., Somerville, Mass. . . Apr. 25, 1907.
George Crompton, . . Treas. Wachusett Mills and Member firm Crompton-Thayer
. . . . . Loom Co., Worcester, Mass. . . Oct. 28, 1897.
William W. Crosby M.E., 53 State St., Room 1112, Boston, Mass. . . . . .
. . . . . Res. 8 Court St., Woburn, Mass . . . Sept. 21, 1905.
John A. Crossland . . Asst. Supt. Skenandoa Cotton Co. . Utica, N. Y. . . . . Apr. 25, 1907.
John Crowther . . . . Treas. Shannock Narrow Fabric Co., Pawtucket, R. I. . . Apr. 25, 1907.
John B. Cudlip . . . . Mgr. Cornwall & York Cotton Mills Co. . . . . .
. . . . . St. John, N. B. . . . Apr. 28, 1897.
H. H. Culver . . . . . Supt. Elizabeth Poole Mills . . . . . .
. . . . . 8 Coram St., Taunton, Mass. . . . Apr. 28, 1897.
Henry S. Culver . . . Treas. Westville Cotton Mills . . . Taunton, Mass. . . . Apr. 28, 1897.
A. G. Cumnock . . . . Treas. Appleton Co., P. O. Box 2284, Lowell, Mass. . . . July 19, 1865.
Frederick E. Cunneen . Asst. Supt. Seaconnet Mills, . . . Fall River, Mass. . . Apr. 26, 1906.
Andrew J. Currier . . . Agt. Nonquitt Spinning Co. . . . . New Bedford, Mass. . Apr. 25, 1888.

Philip Dana . . . . . Supt. Dana Warp Mills . . . . . Westbrook, Me. . . Sept. 29, 1898.
Woodbury K. Dana . . Treas. Dana Warp Mills . . . . . Westbrook, Me. . . . Apr. 25, 1888.
H. M. Daniel . . . . Phila. Mgr. { The Mayo Mills / The Avalon Mills } . . . . . .
. . . . . 517 The Bourse, Philadelphia, Pa. . . Sept. 21, 1905.
F. G. Daniels . . . . . Mgr. Montmorency Branch Dominion Textile Co., Ltd. . .
. . . . . Montmorency Falls, P. Q. Canada . . . . Apr. 17, 1908.

A. Lockwood Danielson Asst. Treas. Quinebaug Co. . . . . Market St., P. O. 900, 20 Providence, R. I. . . Sept. 27, 1894.
John W. Danielson . . Treas. Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., Lewiston B. & D. Works, ... 20 Market St., P. O. Box 900, Providence, R. I. . . July 15, 1868.
John P. Davis . . . . Treasurer Pentucket Narrow Fabric Mills . . . . . 287 Thorndike St., Lowell, Mass. . . . Apr. 17, 1908.
Bradford D. Davol . . Prest. Barnard Mfg. Co., P. O. Box 93, Fall River, Mass. . . Apr. 25, 1877.
Arthur O. Dawson . . Mgr. Selling Department, Canadian Colored Cotton Mills Co. . . . . 28 Victoria Square, Montreal, P. Q. Canada, Oct. 4, 1907.
Albert Deabill . . . . Maryville Hosiery Mills . . . . . Maryville, Tenn. . . Apr. 25, 1901.
Augustus De Cort . . . Treas. De Cort Yarn Co., ... 442 Exchange Building, 53 State St, Boston, Mass. . . . Apr. 26, 1900.
George DeForest . . . Prest. Utica Steam & Mohawk Valley Cotton Mills . . . . . Utica, New York . . Oct. 28, 1897.
George Delano . . . . Treas. Bourne Mills . . . . . Fall River, Mass. . . Apr. 26, 1906.
Henry B. Deming . . Prest. Deming Braiding Co., ... F. O. Box 555, Providence, R. I. . . Apr. 26, 1960.
William P. Dempsey . Treas. and Mgr. Dempsey Bleachery and Dye Works . . . . . Pawtucket, R. I. . . Apr. 28, 1886.
Charles W. Dennett . . Vice Prest. and Gen. Mgr. Hadley Mills, ... P. O. Box 487 Holyoke, Mass. . . . Oct. 29, 1890.
Harlan Ingalls Dennett, Supt. Hadley Mills . . . . . So. Hadley Falls, Mass. . Apr. 27, 1905.
Arthur W. Dennis . . Prest. and Treas. Elmwood Mills . . . . . Dexter, Daboll and Maroney Sts., Providence, R. I. . . Sept. 21, 1905.
Edward P. Dennis . . . . . 50 Chelmsford St., Lowell, Mass. . . . Apr. 25, 1888.
P. Y. DeNormandie . . Member firm Bliss, Fabyan & Co. . . . . 100 Summer St., Boston, Mass. . . . . Apr. 29, 1896.
Charles Owen Dexter . Agt. Beacon Mfg. Co. . . . . New Bedford, Mass., Apr. 24, 1895.
George O. Dexter . . . Supt. Canadian Colored Cotton Mills Co., ... Hamilton, Ont., Canada. Apr. 27, 1905.
Henry C. Dexter . . . Agt. and Sec'y. Greene & Daniels Mfg. Co. . . . . Pawtucket, R. I. . . Apr. 25, 1901.
Lewis Dexter, Jr. . . . Agt. Warner Cotton Mills . . . . . Newburyport, Mass., Apr. 27, 1899.
Albert W. Dimick . . . Agt. Fisher Mfg. Co. . . . . Fisherville, Mass. . . Apr. 25, 1894.
Charles S. Doggett . . Director, Textile Dept. Clemson College . . . . . Clemson College, S. C. Apr. 26, 1906.
James Dolphin . . . . Supt. The Mount Royal Spinning Co., Ltd. . . . . St. Paul, Montreal, Canada . . Oct. 4, 1907.
Robert Dow . . . . . Treas. Solway Dyeing & Textile Co., Pawtucket, R. I. . . April 25, 1901.
Arthur J. Draper . . . { Treas. Hoskins, Louise Calvine and Dover Yarn Mills . . . . . Charlotte, N. C. . . Apr. 23, 1903.
{ Treas. The Pell City Mfg. Co. . . Pell City, Ala. . . .
Eben S. Draper . . . Agt. Draper Co. . . . . Hopedale, Mass. . . Oct. 31, 1888.
George A. Draper . . . Treas. Draper Co. . . . . Hopedale, Mass. . . Oct. 31, 1888.
George Otis Draper . . Sec'y Northrop Loom Co., ... Hopedale, Mass. . . Apr. 24, 1895.
Gen. William F. Draper Textile Improvements . . . . . Hopedale, Mass. . . July 17, 1867.
Henry C. Dresser . . . Supt. McGinnis Cotton Mill . . . . New Orleans, La. . . Apr. 27, 1905.

Harry K. Drew . . . Supt. Royal, Valley Queen and Arctic Mills . . . . . Riverpoint, R. I. . . Oct. 2, 1902.
O. D. Drew . . . . . Supt. Dwight Mfg. Co., 76 Dwight St., Chicopee, Mass. . . Apr. 24, 1902.
Albert J. Dronsfield . . Snpt. Fletcher Mfg. Co., 47 Charles St. Providence, R. I. . . Apr. 17, 1908.
Harry S. Duckworth . . Supt. Print Works, Hamilton Mfg. Co. Lowell, Mass. . . . Apr. 17, 1908.
James B. Duggan . . . . . 41 Jewett Place, Utica, N. Y. . . . . Oct. 2, 1902.
Frederic C. Dumaine, . Treas. Amoskeag Mfg. Co., P. O. Box 2879 . . . . . 64 Ames Building, Boston, Mass. . . . April 25, 1901.
George W. Dunn . . . Purchasing Agt. Lancaster Mills . . Clinton, Mass. . . . Apr. 25, 1907.
John H. Dunn . . . . Gen. Supt. Tremont & Suffolk Mills Lowell, Mass. . . . Oct. 1, 1903.
Frank J. Dutcher . . . Sec'y Draper Co. . . . . Hopedale, Mass. . . Apr. 24, 1902.
David H. Dyer . . . . D. H. Dyer & Son, Mill Engineers, P. O. Box 582, ... Citizens' Bank Building, Fall River, Mass. . . Oct. 18, 1871.

Charles H. Eames . . Principal Lowell Textile School . . Lowell, Mass. . . . Apr. 25, 1907.
Benjamin M. Earle . . Prop. Merchants Dye Works . . . . East Dedham, Mass. Sept. 26, 1901.
Russell W. Eaton . . . Agt. Cabot Mfg. Co. . . . . Brunswick, Me. . . . Oct. 27, 1887.
John Eccles . . . . . Agt. Ponemah Mills . . . . . Taftville, Conn. . . . Apr. 27, 1892.
Jesse P. Eddy, ... Treas. Tillinghast Stiles Co., and Prest. and Treas. . . . . Fitch Mfg. Co., P. O. Box 1566, Providence, R. I. . . Sept. 21, 1905.
Oscar Elsas . . . . . Vice-Prest. Fulton Bag & Cotton Mills, ... P. O. Box 773, Atlanta, Ga. . . . . Apr. 28, 1897.
William E. Elsberry . . Sec'y and Treas. Tallassee Falls Mfg. Co. . . . . Tallassee, Ala. . . . Sept. 13, 1906.
Frederick W. Ely . . . Agt. Columbian Mfg. Co. . . . . Greenville, N. H. . . Apr. 25, 1888.
H. B. Estes . . . . . Agt. Continental Mills . . . . . Lewiston, Me. . . . Apr. 26, 1893.
John H. Estes . . . . Cotton Manufacturer . . . . . Fall River, Mass. . . Apr. 23, 1903.
James C. Eteson . . . Supt. Orswell Mills, ... Fitchburg, Mass. . . Sept. 22, 1904.
William Evans . . . . Gen. Supt. Hargraves & Parker Mills, ... 295 Winter St., Fall River, Mass. . Apr. 29, 1896.
D. A. Everly . . . . . 395 Water St., Fitchburg, Mass. . . Apr. 24, 1902.

Wm. Kendall Fairbanks Agt. Bigelow Carpet Co., Market St., Lowell, Mass. . . . Apr. 25, 1907.
Charles F. Farrar . . . . . 49 Coggeshall St., Fall River, Mass. . . Oct. 28, 1897.
George E. Farrell . . . Sec'y. Ontario Knitting Co. and Standard Yarn Mills . . . . . P. O. Box 3, Oswego, N. Y. . . . Oct. 18, 1900.
Vernon C. Faunce . . . Supt. Hamilton Mfg. Co. . . . . Lowell, Mass. . . . Apr. 17, 1908.
Alfred L. Ferguson . . Treas. Windsor Print Works, 15 William St., New York City, Oct. 4, 1907.
James T. Ferguson . . Supt. Warwick Mills . . . . . Centreville, R. I. . . Oct. 5, 1899.
John A. Fernley . . . Supt. Butler Mill . . . . . New Bedford, Mass. . Sept. 22, 1904.
Frank S. Field . . . . Asst. Treas. Massaemit Yarn Mills . Shattuckville, Mass. . Oct. 25, 1895.
Eugene Finocchiaro . . . . . 17 Bloomingdale St., Chelsea, Mass. . . . Apr. 28, 1904.
William Firth . . . . Prest. American Moistening Co. and Prest Wm. Firth Co., ... 79 Milk St., Boston, Mass. . . . . Apr. 25, 1888.
George Fish . . . . . Treas. & Mgr. Knapp Spinning Mills, Richmond, Me. . . Apr. 27, 1905.

Henry E. Fisher . . . Vice-Prest.&Treas. Atlanta Cotton Mills, Atlanta, Ga. . . . . Oct. 25, 1895.
F. C. Fletcher . . . Vice Prest. Lawton Spinning Co. . . . . 621 Banigan Building, Providence, R. I. . . Oct. 18, 1900.
Benjamin Forster . . . Supt. Weaving, I. E. Palmer Mill . . . . . 71 Spring St., Middletown, Conn. . Apr. 26, 1906.
Henry J. Forsyth . . . Supt. Springstein Mill, ... Chester, S. C. . . . . Oct. 1, 1903.
Eugene N. Foss . . . Prest. Burgess Mills, . 34 Oliver St., Boston, Mass. . . . Apr. 25, 1907.
John W. Foster . . . . Asst. Supt. Print Works, Hamilton Mfg. Co. . . . . 36 Gates St., Lowell, Mass. . . . Apr. 26, 1906.
M. F. Foster . . . . . Milford, N. H. . . . Apr. 17, 1872.
Thomas William Fox . M. Sc. Tech., Prof. of Textiles Municipal School of Technology, Manchester, Eng., ... 15 Clarendon Crescent, Eccles, Eng. . . . . Apr. 17, 1908.
Edward W. France . . Dir. of Philadelphia Textile School, ... 320 So. Broad St., Philadelphia, Pa. . . Sept. 22, 1896.
John W. France . . . Supt. The Aberfoyle Mfg. Co., and the Galey & Lord Mfg. Co. . . . . 427 East Broad St., Chester, Pa. . . . . Sept. 21, 1905.
Allan A. Freeman . . Prest. Atlantic Fibre Co., Sloatsburg, Rockland Co., N. Y. Apr. 25, 1907.
Arthur C. Freeman . . Textile Finishing Machinery Co. . . . . 83 Exchange Place, Providence, R. I. . . Apr. 27, 1899.
Simon Friedberger . . Prest. Friedberger-Aaron Mfg. Co. . . . . Tenth and Diamond Sts., Philadelphia, Pa. . . Apr. 23, 1903.
John W. Fries . . . { Managing Partner, F. & H. Fries & Prest. Arista Mills Co. . . . } Winston-Salem, N.C., . Oct. 18, 1900.
C. H. Frisbie . . . . Agt. Attawaugan Co. . . . . Norwich, Conn. . . . Oct. 29, 1890.
Hachiro Henry Fukuhara, Supt. Sumoto Mill, Kanegafuchi Spinning Co. . . . . Hiogo, Japan, . . . Apr. 28, 1904.
William A. Fuller . . . Treas. Hudson Converting Co. . . . . 330 Church St., Clinton, Mass. . . . Oct. 4, 1907.

S. L. Gabriel . . . . . Treas. United States Linen Co. . . Taunton, Mass. . . . Sept. 22, 1904.
W. T. Galey . . . . . Prest. Aberfoyle Mfg. Co. . . . . Chester, Pa. . . . . Apr. 28, 1897.
William Gammell . . . Agt. Berkeley Co. . . . . Providence, R. I. . . Oct. 28, 1885.
Arnold C. Gardner . . Treas. Manomet Mills, 76 Bedford St., New Bedford, Mass. Apr. 26, 1906.
James G. Garland . . . Prest. The Garland Mfg. Co. . . Saco, Me. . . . . Oct. 29, 1879.
William H. Garner . . Agt. Newmarket Mfg. Co. . . . . Newmarket, N. H. . Sept. 22, 1904.
Edward T. Garsed . . . . . Charlotte, N. C. . . Apr. 27, 1898.
Walter R. Garsed . . . Mgr. Wingohocking Cotton Mills . . . . . Frankford, Philadelphia, Pa. . . Oct. 1, 1903.
E. Stanley Gary . . . Vice Prest. and Gen. Mgr. Gary Mfg. Co. . . . . 724 Equitable Bldg. Baltimore, Md. . . . Oct. 1, 1903.
James A. Gary . . . . Prest. Gary Mfg. Co. . . . . 720–724 Equitable Bldg., Baltimore, Md. . . . Apr. 25, 1883.
Alfred C. Gaunt . . . Treas. Tremont Worsted Co . . . Methuen, Mass. . . Apr. 25, 1907.
James Gee . . . . . Supt. Interlaken Dye Works . . . . Fiskville, R. I. . . . Apr. 27, 1898.

S. P. Gerow . . . . . Treas. and Sec'y The Cornwall & York Cotton Mills . . .
. . . . . St. John, N. B. . . . Apr. 25, 1907.
Charles E. Getchell . . Prest. Waltham Emery Wheel Co. . . . . .
. . . . . 115 Bacon St., Waltham, Mass. . . . Oct. 30, 1889.
R. H. I. Goddard, Jr., . Goddard Bros. . 50 South Main St., Providence, R. I. . . Apr. 27, 1905.
William C. Godfrey . . Agt. Indian Orchard Co. . . . . Indian Orchard, Mass. Oct. 29, 1890.
Otto Goetze, ... Gen'l. Mgr. Glasgow Mills, Orthodox and Horrocks Sts.,
. . . . . Frankford, Philadelphia, Pa. . . Apr. 24, 1902.
Albert H. Goff . . . . Mill Supt. D. Goff & Son, 29 River St., Pawtucket, R. I. . . Apr. 25, 1907.
Lyman B. Goff . . . . Prest. Union Wadding Co. . . . . Pawtucket, R. I. . . Sept. 21, 1905.
Alfred M. Goodale . . Cloth & Yarn Broker . 40 State St., Boston, Mass. . . . . Apr. 25, 1883.
C. B. Gordon . . . . . Vice Prest. Dominion Textile Co., Ltd. . . . . .
. . . . . 112 St. James St. Montreal, P. Q. Canada Sept. 13, 1906.
Frederick B. Gordon . Prest. Columbus Mfg. Co. . . . . Columbus, Ga. . . . Apr. 26, 1900.
Charles H. Gorton . . Mgr. Aragon Mills, . Polk County., Aragon, Ga. . . . . Apr. 25, 1894.
J. Whidden Graham . Supt. St. Croix Mill, Canadian Col'd Cotton Mill Co. . .
. . . . . Milltown, New Brunswick . . Apr. 26, 1906.
George P. Grant, Jr. . . Treas. Grant Yarn Co. . . . . Fitchburg, Mass. . . Sept. 27, 1894.
Charles T. Grantham . Gen. Mgr. Imperial Cotton Co., Hamilton, Ont., Cosmos
. . . . . Cotton Mill, Yarmouth, Nova Scotia, Hamilton, Ont., Ca., . Apr. 17, 1908.
D. W. Gray . . . . . District Mgr. Columbia Mills Co., . Columbia, S. C. . . . Oct. 26, 1892.
R. A. Gray . . . . . Supt. Rodman Mfg. Co. . . . . Allenton, R. I. . . . Apr. 24, 1895.
C. Singleton Green . . Sec'y Consolidated Cotton Duck Co. . . . . .
. . . . . 809 Continental Trust Building, Baltimore, Md. . . . Apr. 17, 1908.
Edwin Farnham Greene, Treas. Pacific Mills; Prest. Lockwood, Greene & Co. . .
. . . . . 70 Kilby St., Boston, Mass. . . . . Apr. 24, 1902.
Joseph Warren Greene . Supt. Hamilton Web Co. . . . . Hamilton, R. I. . . . Apr. 29, 1896.
S. Harold Greene . . . Treas. The Lawton Mills Corporation . . . . . .
. . . . . 93 Federal St., Boston, Mass. . . . Apr. 27, 1905.
William C. Greene . . Treas. Peace Dale Mfg. Co. . . . Peace Dale, R. I. . . Oct. 27, 1886.
S. Greenwood . . . . Mgr. Canadian Col'd Cot. Mills Co. Ltd. . . . . .
. . . . . Cornwall, Ontario, Canada, . . Oct. 5, 1899.
William K. Greer . . . Asst. Supt. Eclipse & Beaver Mills . . . . . .
. . . . . P. O. Box 258, North Adams, Mass. Apr. 26, 1906.
John Gregson . . . . Supt. Peabody Mfg. Co., P. O. Box 304, Newburyport, Mass. . Apr 24, 1895.
Maxwell Grierson . . . Gen. Mgr. Jas. Chadwick & Bro., Ltd., Jersey City, N. J. . . Apr. 27, 1898.
Adam H. Groel . . . Supt. Clark Mile End Spool Cotton Co. East Newark, N. J. . Sept. 21, 1905.
David Grove . . . . . Supt. U. S. Cotton Co. . . . . Central Falls, R. I. . Apr. 27, 1898.
George W. Grove . . . Treas. Argo Mills Co. . . . . Gloucester City, N. J. Sept. 21, 1905.
Henry S. Grove . . . Prest. Argo Mills Co., 318 Mariners and Merchants Bldg.
. . . . . Third and Chestnut Sts., Philadelphia, Pa. . . Apr. 27, 1898.
Louis I. Guion . . . . Supt. Columbia Mills Co., ...
. . . . . P. O. Box 130 . Columbia, S. C. . . . Oct. 2, 1902.
Percy Gulline . . . . Supt. Merrimack Print Works, ...
. . . . . 197 Pawtucket St., Lowell, Mass. . . . Sept. 21, 1905.
Arthur H. Gulliver . . . Mgr. Wyoming Spinning Co., . . . Norristown, Penn. . Apr. 24, 1889.
Frank B. Gustafson . . Asst. Supt. I. E. Palmer Co., Cotton Spinning Mill . . .
. . . . . 88 Wyllys Ave., Middletown, Conn. . Apr. 26, 1906.

Frank J. Hale . . . . Gen. Agt. Saco and Pettee Machine Shops . . . . . Newton Upper Falls, Mass. . Apr. 27, 1892.
Walter B. Hall . . . . V. P. West Warren Cotton Mills . . West Warren, Mass. . Apr. 25, 1901.
William E. Hall . . . Treas. and Mgr. Shaw Stocking Co., Lowell, Mass. . . . Apr. 27, 1892.
Z. D. Hall . . . . . Supt. Berkshire Cotton Mfg. Co. . . . . 70 Orchard St., P. O. Box 963, Adams, Mass. . . . Oct. 29, 1879.
William Halliwell . . . V. P. Solway Dye & Textile Co. . Pawtucket, R. I. . . Sept. 21, 1905.
William Halliwell, . . Agt. Providence and Woonsocket Mills of the Lawton Spin- . . . . . ning Co., Woonsocket, R. I. . Sept. 26, 1901.
Alton L. R. Hambly, . Supt. Quidnick Mfg. Co. . . . . Quidnick, R. I. . . Apr. 26, 1906.
John H. Hambly . . . Treas. Quidnick Mfg. Co. and Treas. Windham Mfg. Co. . . . . 49 Westminster St, Providence, R. I. . . Apr. 24, 1895.
Maylin Hamburger . . Eastern Mgr. . . . . 2 Hudson St., New York, N. Y., . Sept. 21, 1905.
Arthur M. Hamilton . . . . . General Delivery, Charlotte, N. C. . . Apr. 28, 1897.
John F. Hamlet . . . Manufacturer . . . P. O. Box 160, Fall River, Mass. . . Oct. 31, 1888.
Peter Hardman . . . Supt. American Thread Co., Willimantic Mills . . . . . 137 Windham St., Willimantic, Conn. . Apr. 23, 1903.
J. Potter Harrington . Agt. Saratoga Victory Mills . . . . Victory Mills, N. Y. . Apr. 25, 1907.
Henry F. Harris . . . Treas. West Boylston Mfg. Co. . . . . 340 Main St., Worcester, Mass. . . Apr. 30, 1890.
W. G. Hartford . . . Treas. & Mgr: Monarch Woolen Mills Montville, Conn. . . Apr. 23, 1903.
Frank Hartley . . . . Supt. S. Slater & Sons, Inc. Print and Dye Works . . . . . Webster, Mass, . . . Apr. 27, 1905.
Walter M. Hastings . . Asst. to Agt. Arlington Mills . . . Lawrence, Mass. . . Apr. 23, 1903.
Chester D. Hatch . . Agt. Exeter Mfg. Co., ... Exeter, N. H. . . . . Apr. 28, 1904.
William E. Hatch . . Prest. New Bedford Textile School, ... 166 William St., New Bedford, Mass. . Sept. 22, 1904.
William Hathaway . . Supt. Barnard Manufg. Co. . . . . Fall River, Mass. . . Apr. 25, 1894.
William B. Hawes . . Yarn Broker . . . 108 Bedford St., ... P. O. Box 733, Fall River, Mass. . . Apr. 24, 1895.
Charles Hayes, Jr. . . Supt. Skenandoa Cotton Co. . . . Utica, N. Y . . . . Apr. 26, 1906.
William Hayes . . . . Agt. Barker Mill . . . . . Auburn, Me. . . . . Apr. 30, 1879.
Harry T. Hayward . . Prest. Forestdale Mfg. Co. . . . . Franklin, Mass. . . . Apr. 25, 1907.
W. G. Henderson . . . Agt. Falls Co. . . . . Norwich, Conn. . . . Apr. 29, 1896.
A. E. Henry . . . . . Mystic, Conn. . . . Apr. 25, 1901.
James Henry . . . . . Thos. Henry & Sons . . . . . Trenton Ave. and Tioga St., Philadelphia, Pa. . . Oct. 1, 1903.
William G. Henry . . Thos. Henry & Sons . . . . . Trenton Ave. and Tioga St., Philadelphia, Pa. . . Oct. 1, 1903.
Arthur N. Hersom . . Tallassee Falls Mfg. Co. . . . . Tallassee, Ala. . . . Apr. 28, 1904.
Ernest L. Hersom . . Supt. Nockedge Mills 40 Mechanic St., Fitchburg, Mass. . . Apr. 23, 1903.
T. I. Hickman, ... Prest. and Treas. Graniteville Mfg. Co. . . . . Leonard Bldg., Augusta, Ga. . . . . Apr. 25, 1901.
Hiram Higham . . . . Supt. 4 and 5 Wamsutta Mills . . . . . 197 Summer St., New Bedford, Mass. . Oct. 1, 1903.
William H. Hill . . . Prest. Renfrew Mfg. Co., ... 50 Congress St., Room 810, Boston, Mass. . . . Apr. 24, 1902.

George H. Hills . . . Treas. Davol Mills and Treas. Stevens Mfg. Co., ...
. . . . . Fall River, Mass. . . Oct. 25, 1895.
Alexander F. Hobbs . . Resident Mgr. U. S. Finishing Co . . Providence, R. I. . . Apr. 27, 1905.
Franklin W. Hobbs . . Treas. Arlington Mills . . P. O. Box 200, Essex St. Station
. . . . . 78 Chauncy St., Boston, Mass. . . . Apr. 27, 1899.
William Henry Hobbs . Supt. The Red Cross Cotton Mills New Brunswick, N. J. . Apr. 24, 1902.
Clark W. Holcomb . . Treas. Old Colony Mills, Taunton, ...
. . . . . P. O. Box 5, New Bedford, Mass. . Sept. 21, 1905.
Walter J. Holden . . . Supt. Boott Mills, 1164 Middlesex St., Lowell, Mass. . . . . Oct. 4, 1907
Charles M. Holmes . . Agt. Manomet Mills, ...
. . . . . P. O. Box 96, New Bedford, Mass. . Apr. 27, 1899.
Gideon F. Holmes . . Treas. and Gen. Mgr. Plymouth Cor- . . . . . .
. . . . . dage Co. . . . . No. Plymouth, Mass. . Oct. 30, 1889.
George W. Holt . . . Agt. Monohansett Mfg. Co. . . . . Putnam, Conn. . . . Oct. 29, 1879.
John H. Holt . . . . Supt. Luther Mfg. Co. . . . . Fall River, Mass. . . Apr. 23, 1903.
Walter L. Holt . . . . Prest. Holt-Morgan Mills . . . . . Fayetteville, N. C. . . Oct. 18, 1900.
William P. Holt . . . . . West Warren, Mass. Oct. 25, 1893.
Robert P. Hooper . . Treas. Hooper Sons Mfg. Co., ...
. . . . . 509 Arch St., Philadelphia, Pa. . . Sept. 21, 1905.
Wm. E. Hooper . . . V. P. & Mgr. Woodberry Div. of Mt. Vernon Woodberry Co.
. . . . . 50 Baltimore Life Bldg., Baltimore, Md. . . . Apr. 23, 1903.
H. B. Hopson . . . . Supt. Spool Cotton Dept., Bibb Mfg. Co. . . . . .
. . . . . P. O. Box 98, Macon, Ga. . . . . Apr. 28, 1904.
Herbert H. Horton . . Treas. Troy Cotton & Woolen Manufactory . . . . . .
. . . . . Fall River, Mass. . . Apr. 17, 1908.
Amos G. Hosmer . . . Mech. Supt. Lancaster Mills . . . . . .
. . . . . 40 Chestnut St., Clinton, Mass. . . . Apr. 25, 1907.
Edward W. Houghton Supt. Globe Mill, . . Manville Co., Woonsocket, R. I. . Apr. 24, 1902.
W. C. Houston . . . . Prest. Hope Mills Mfg. Co. . . . . .
. . . . . 355 Drexel Building, Philadelphia, Pa. . . Apr. 28, 1897.
Charles M. Howard . . Vice Prest. Windsor Print Works . . . . . .
. . . . . 65 Worth St., New York City . . . Oct. 4, 1907.
Elisha H. Howard . . Agt. Slater Cotton Co., 49 Church St., Pawtucket, R. I. . . Apr. 25, 1907.
Henry S. Howe . . . . Mem. firm Lawrence & Co., 89 Franklin St., Boston, Mass. Oct. 31, 1877.
Walter J. Howland . . Supt. Hebron Mfg. Co., Hebron Mills, Hebronville, Mass. . Apr. 25, 1907.
Albert C. Hoy . . . . Grosvenor Dale Co., . P. O. Box 872, Providence, R. I. . . Apr. 27, 1898.
Charles W. Hubbard . Treas. and Sec. Ludlow Mfg. Associates . . . . . .
. . . . . 55 Congress St., Boston, Mass. . . . Apr. 25, 1901.
W. S. Hume, ... Supt. Hamilton Woolen Co. . . . . Amesbury, Mass. . . Apr. 25, 1907.
Otis L. Humphrey . . Harding, Whitman & Co., 78 Chauncy St., Boston, Mass. Apr. 25, 1901.
Arthur W. Hunking . . . . . 374 Stevens St., Lowell, Mass. . . Apr. 24, 1895.

D. Edwin Irving . . . Treas. The Irving & Leiper Mfg. Co., Chester, Pa. . . . . Oct. 28, 1897.

P. T. Jackson, Jr. . . . Treas. Lowell Weaving Co. . . . . Lowell, Mass. . . . Sept. 21, 1905.
Joseph B. Jamieson . . Prest. Holmes Knitting Co. . . . . .
. . . . . 77 Summer St., Room 80, Boston, Mass. . . . Oct. 2, 1902.

Earl S. Jenckes	Supt. Paul Whitin Mfg. Co.	Northbridge, Mass.	Apr. 27, 1905.
Frederick L. Jenckes	Agt. Jenckes Spinning Co.	Pawtucket, R. I.	Apr. 25, 1907.
J. E. Jenckes	Treas. E. Jenckes Mfg. Co. and Treas. E. Jenckes Spinning Co.	Pawtucket, R. I.	Apr. 24, 1895.
William H. Jenekes	Supt. Nonquit Spinning Co.	1786 Acushnet Ave., New Bedford, Mass.,	Apr. 17, 1908.
Edward B. Jennings	Treas. Samoset Co.,	Valley Falls, R. I.	Sept. 29, 1898.
W. H. Jillson	Mfr. Cotton Yarns	Westfield, Mass.	Apr. 26, 1906.
Leonard Johnson	Supt. Page Mfg. Co.	9 Allen St., New Bedford, Mass.	Oct. 1, 1903.
David S. Johnston	Gen. Supt. Harmony Mills	Cohoes, N. Y.	Oct. 28, 1891.
Gordon A. Johnstone	Agt. Danielson Cotton Co.	Danielson, Conn.	Apr. 23, 1903.
W. T. Jordan		Atlanta, Ga.	Oct. 25, 1895.
Nelson D. Keables	Mech. Supt. Mass. Cotton Mills	14 Hoyt Ave., Lowell, Mass.	Apr. 26, 1906.
W. E. Keach	Supt. Grant Yarn Co., 21 Burnap St.,	Fitchburg, Mass.	Oct. 26, 1892.
Roland R. Kelly	Supt. Williamstown Mfg. Co.	Williamstown Sta., Mass.	Nov. 30, 1881.
James B. Kerr	Agt. American Thread Co.	Kerr Mills, Fall River, Mass.	Apr. 25, 1907.
Nathaniel B. Kerr	Treas. Butler Mill	New Bedford, Mass.	Oct. 26, 1892.
Horace A. Keith	Treas. Brockton Webbing Co.	26 Pinkham St., Brockton, Mass.	Oct. 4, 1907.
Harry W. Kimball	Supt. Mt. Vernon Mills	Hampden, Baltimore, Md.	Oct. 25, 1895.
William N. Kimball	Supt. Social and Nourse Mills, Manville Company	Woonsocket, R. I.	Apr. 24, 1902.
Robert F. Kineavy	Supt. Arasapha Mfg. Co.	Chester, Pa.	Sept. 21, 1905.
Alexander King, Jr.	Asst. Supt. American Thread Co.	Fall River, Mass.	Apr. 27, 1905.
John T. Kirk	Supt. Weaving Slater Cotton Co., P. O. Box 697	Pawtucket, R. I.	Apr. 27, 1905.
Jesse A. Knight	Asst. Treas. and Supt. Argo Mills Co.	Gloucester City, N. J.	Oct. 26, 1892.
Walter B. Knight	Supt. The Windham Mfg. Co.	Willimantic, Conn.	Apr. 24, 1889.
John Kniveton	Instr. Weaving and Warp Preparation,	The Bradford Durfee Textile School, Fall River, Mass.,	Sept. 22, 1904.
John W. Knowles	Treas. Page Mfg. Co.	New Bedford, Mass.	Sept. 13, 1906.
Arthur Kuffler	Prest. Austrian Cotton Spinners' Association, Member firm	Kuffler & Reichel, 34 Maria Theresienstrasse, Vienna, Austria	Oct. 4, 1907.
Fred Lacey	Supt. Boott Mills	Lowell, Mass.	Apr. 24, 1895.
Elliott Cowdin Lambert,	Supt. Amoskeag Mfg. Co.	Manchester, N. H.	Oct. 25, 1895.
William T. Lang	Agt. Brookside Mills	Knoxville, Tenn.	Apr. 28, 1897.
Walter H. Langshaw	Agt. and Prest. Dartmouth Mfg. Corp., Prest. Bristol Mfg. Corp.	New Bedford, Mass.	Apr. 29, 1896.
Leonard C. Lapham	Treas. Nonquitt Spinning Co.	New Bedford, Mass.	Apr. 25, 1907.
Harold Lawton	V. P. & Gen. Mgr. The Lawton Mills, Corp.	Plainfield, Conn.	Oct. 27, 1886.
Berry Laycock	Supt. Franklin Mills Corp.	Unionville, Franklin, Mass.	Apr. 25, 1907.

Calvin H. Lee . . . . Supt. Readville Cotton Mills . . . Hyde Park, Mass. . . Apr. 24, 1902.
William A. Lehan . . . Supt. Burgess Mills . . . . . .
. . . . . 133 Mineral Spring Ave., Pawtucket, R. I. . . Apr. 25, 1907.
Evan Arthur Leigh . . Textile Machinery 232 Summer St., Boston, Mass. . . . . Oct. 29, 1890.
J. Colby Lewis . . . . Agt. Salmon Falls Mfg. Co. . . . . Salmon Falls, N. H. . Oct. 26, 1892.
Charles F. Libby . . . Supt. Shaw Stocking Co. . . . . Lowell, Mass. . . . Apr. 24, 1902.
Leontine Lincoln . . . Prest. Seaconnet Mills . . . . . Fall River, Mass. . . Apr. 28, 1897.
Henry F. Lippitt . . . Gen. Mgr. Manville Cos., P.O. Box 139, Providence, R. I. . . Apr. 27, 1881.
Alfred Lister . . . . . Mech. Supt. Clark Mile End Spool Cotton Co. . . . . .
. . . . . East Newark, N. J. . Apr. 17, 1908.
L. A. Lockwood . . . Prest. Crefeld Waste & Batting Co. and Prest. The L. A.
. . . . . Lockwood Co., ... Saylesville, R. I. . Sept. 21, 1905.
William H. Loftus . . Supt. Clark Thread Co. . . . . Newark, N. J. . . . Oct. 28, 1897.
Harry D. Lord . . . . Selling Agt. Saco and Pettee Machine Shops . . . . . .
. . . . . 323 Main St., Biddeford, Me. . . . Apr. 27, 1905.
Hartley L. Lord . . . Gen. Mgr. Union-Buffalo Mills Co. . Union, S. C. . . . . Apr. 26, 1906
John T. Lord, ... Supt. Pacific (Lower) Mills . . . . Lawrence, Mass. . . Apr. 28, 1904.
Robert W. Lord . . . . . Kennebunk, Me. . . Oct. 20, 1869.
Henry M. Lovering . . Treas. Dwight Mfg. Co., 53 State St., Boston, Mass. . . . . Oct. 27, 1880.
William C. Lovering . Prest. Whittenton Mfg. Co. . . . . .
. . . . . 50 State St., Boston, Mass. . . . Oct. 25, 1876.
William M. Lovering . . . . . Taunton, Mass. . . Sept. 27, 1894.
Arthur H. Lowe . . . Treas. Wm. Lowe Mfg. Co., Huntsville, Ala., Prest. Lancaster
. . . . . Mills, Clinton, Mass., and Treas. Parkhill Mfg. Co. . . .
. . . . . Fitchburg, Mass. . . Oct. 30, 1889.
David Lowe . . . . . Supt. Parkhill Mfg. Co. . . . . Fitchburg, Mass. . . Apr. 24, 1895.
Russell B. Lowe . . . Prest. Parkhill Mfg. Co. . . . . Fitchburg, Mass. . . Apr. 25, 1907.
Charles B. Luther . . . Treas. Luther Mfg. Co. . . . . .
. . . . . 240 Hartwell St., P. O. Box 57, Fall River, Mass. . . Sept. 22, 1904.
William L. Lyall . . . Treas. Brighton Mills . . . . . Passaic, N. J. . . . . Oct. 26, 1892.
Herbert Lyman . . . . . 56 Marlborough St., Boston, Mass. . . . Oct. 25, 1895.
Ronald T. Lyman . . . Treas. Boston Mfg. Co. . . . . .
. . . . . 50 State St., P. O. Box 1717, Boston, Mass. . . . Oct. 1, 1903.

Hugh Walkinson Macalister, Managing Dir. Springhead Spinning Co., Ltd., Lees .
. . . North Oldham, Eng., Res. 276 Dickinson Road, Manchester, Eng. . . Oct. 4, 1907.
C. W. Macara . . . . Mgr. Henry Bannerman & Sons, Ltd., Prest. Federation of
. . . . . Master Cotton Spinners' Associations, Chairman Inter-
. . . . . national Cotton Committees . . . . . .
. . . . . 33 York St., Manchester, England. Apr. 25, 1907.
Sr. D. Roman Macaya . Mutua de Fabricantes de Tejidos . . . . . .
. . . . . Carribia 6, Barcelona, Spain . . Apr. 17, 1908.
W. H. Macdonald . . Asst. Supt. St. Croix Mill, Canadian Col'd Cotton Mill Co.,
. . . . . Milltown, New Brunswick . . Apr. 26, 1906.
John MacManus . . . Supt. The Utica Willowvale Bleachery Co. . . . . .
. . . . . Chadwicks, N. Y. . . Apr. 17, 1908.

Charles L. Macomber . Prest. Winthrop Cotton Yarn Co. . Taunton, Mass. . . . Apr. 24, 1895
Frederick B. Macy, . . Treas. Soule Mills, ... New Bedford, Mass. . Apr. 25, 1901.
Amos G. Maddox . . . Supt. Linwood Cotton Mill . . . . Linwood, Mass. . . . Oct. 18, 1900.
Charles T. Main . . . Mill Engineer, ...
. . . . . 45 Milk St., Room 907, Boston, Mass. . . . Oct. 28, 1885.
Alexander Makepeace . Supt. Richard Borden Mfg. Co. . . Fall River, Mass. . . Oct. 1, 1903.
Charles R. Makepeace . Mill Engineer and Treas. United Lace and Braid Mfg. Co.
. . . . . Butler Exchange Bldg., P. O. Box 973, Providence, R. I. . Apr. 30, 1890.
Vladimir Malinin, M. E., Prochoroff Three Hill Mfg. Co. . . . . .
. . . . . Presnja St., Moscow, Russia . . . Apr. 23, 1903.
J. D. Mallory . . . . Lindale Inn . . . . . Lindale, Ga. . . . . Apr. 27, 1905.
Fred B. Manley . . . Treas. Atlantic Mills . . . . . Providence, R. I. . . Apr. 26, 1906.
Arthur B. Mann . . . J. H. Martin & Co., 99 Franklin St., New York, N. Y. . . Apr. 25, 1894.
Charles H. Manning . . Supt. Amoskeag Mfg. Co. . . . . Manchester, N. H. . Oct. 28, 1885.
Henry F. Mansfield . Supt. Utica Steam Cotton Mills and Supt. Mohawk Valley
. . . . . Cotton Mills. . . . . Utica, N. Y . . . . Apr. 30, 1890.
Paul J. Marrs . . . . Treas. Henderson Cotton Mills . . Henderson, Ky. . . Oct. 28, 1897.
Henry D. Martin . . . Supt. Lancaster Mills . . . . . Clinton, Mass. . . . Apr. 28, 1897.
Arthur H. Mason . . . Treas. Davis Mills . . . . . Fall River, Mass. . . Oct. 2, 1902.
Frederick R. Mason . . Prest. and Treas. The Robert D. Mason Co. . . . . .
. . . . . Pawtucket, R. I. . . Sept. 21, 1905.
Philip A. Mathewson . Supt. King Philip Mills, ...
. . . . . P. O. Box 607, Fall River, Mass. . . Apr. 24, 1895.
Scott Maxwell . . . . Agt. Indian Head Mills of Ala. . . Cordova, Ala. . . . . Sept. 26, 1901.
Andrew W. McAllister . . . . . Redlands, Cal. . . . Apr. 28, 1904.
Robert McArthur . . . Agt. Pepperell Mfg. Co. . . . . Biddeford, Me. . . . Apr. 17, 1872.
Thomas McAuliffe . . Supt. Stevens Mfg. Co. . . . . Fall River, Mass. . . Apr. 27, 1898.
Edward J. McCaughey . Sec'y Home Bleach & Dye Works . . . . . .
. . . . . 106 Spring St., Pawtucket, R. I. . . Apr. 26, 1906.
Fred C. McDuffie . . Treas. Everett Mills and Treas. York Mfg. Co., ...
. . . . . P. O. Box 2934, 24 Milk St., Boston, Mass. . . Oct. 25, 1882.
Robert P. McEwen . . Treas. Mt. Pleasant Banding Corp. . New Bedford, Mass. . Apr. 26, 1906.
John G. McFadden . . Supt. Natick Mills . . . . . Natick, R. I. . . . . Oct. 1, 1903.
David H. McKinley . . Prop. Philadelphia Thread Co. . . . . .
. . . . . Hancock and Oxford Sts., Philadelphia, Pa. . . Sept. 21, 1905.
James A. McLane . . Supt. Davis Mills . . . . . Fall River, Mass. . . Oct. 2, 1902.
John E. McLaughlin . Sec'y., Treas. and Mgr. La Tosca Yarn Mill . . . . . .
. . . . . Utica, N. Y. . . . . Apr. 25, 1907.
William G. McLoon . . . . . Waltham, Mass. . . Apr. 27, 1892.
R. P. McLoughlin . . Asst. Treas. and Asst. Mgr. La Tosca Yarn Mill . . . . .
. . . . . Utica, N. Y. . . . . Sept. 13, 1906.
Robert G. McMeehan, . New York Mills, ... Oneida County, N. Y. Sept. 26, 1901.
William P. McMullan . Agt. Naumkeag Steam Cotton Co. . Salem, Mass. . . . . Sept. 27, 1894.
Robert B. Meikle . . . Supt. Lorraine Mfg. Co. . . . . Westerly, R. I. . . . Apr. 23, 1903.
Henry P. Meikleham, . Agt. Mass. Mills in Georgia . . Lindale, Floyd County, Ga. Apr. 26, 1900.
Joseph Mercer . . . . Agt. and Treas. Mercer Mfg. Co. . Montville, Conn. . . Apr. 24, 1902.
Bernard F. Merriam . . Treas. Cordaville Woolen Co. . . . So. Framingham, Mass. Apr. 25, 1907.

Joseph Merriam . . . Prest. Springfield Webbing Co. . . Middletown, Conn. . Oct. 2, 1902.
Charles H. Merriman, Jr. Manville Co., Board of Trade Bldg., Providence, R. I. . . Apr. 24, 1895.
James G. Merriman, Jr. . Mgr. Standard Spinning Co. . . . . Oswego, N. Y. . . . Sept. 21, 1905.
Joseph B. Miller . . . Prest. Miller & Sons Co. . . . . 5309 Westminster Ave., Philadelphia, Pa. . . Oct. 4, 1907.
R. M. Miller, Jr. . . . Prest. & Treas. Elizabeth Mills . . Charlotte, N. C. . . . Sept. 29, 1898.
Simon Miller . . . . . Member Firm Jacob Miller Sons & Co., Borich Mills . . . . . 16th & Reed Sts., Philadelphia, Pa. . . Apr. 26, 1906.
Theodore F. Miller . . Stead & Miller Co., 4th & Cambria Sts., Philadelphia, Pa. . . Oct. 4, 1907.
Albert D. Milliken . . Supt. New England Cotton Yarn Co., ... 237 Summer St., New Bedford, Mass. Apr. 25, 1907.
Almon A. Milliken . . Supt. The Jackson Mfg. Co. . . . . Nashua, N. H. . . . Sept. 21, 1905.
James I. Milliken . . . Agt. Everett Mills . . . . . Lawrence, Mass. . . Oct. 26, 1892.
Roscoe S. Milliken . . Agt. Nashua Mfg. Co. . . . . Nashua, N. H. . . . Apr. 29, 1896.
David Milne . . . . . C. J. Milne & Sons . . . . . Washington Ave. & 10th and 11th Sts., Philadelphia, Pa. Apr. 28, 1897.
William A. Mitchell . . Mfg. Supt. Mass. Cotton Mills . . . . . P. O. Box 1230, Lowell, Mass. . . Apr. 25, 1907.
A. B. Mole . . . . . Gen. Mgr. Dominion Textile Co. Ltd. . . . . 210 Milton St., Montreal, P. Q. . . . Apr. 24, 1895.
Edward A. Mongeon . Supt. Lonsdale Mills . . . . . Lonsdale, R. I. . . . Apr. 24, 1895.
George M. Montgomery Vice Prest. The J. R. Montgomery Co. Windsor Locks, Conn. Sept. 22, 1904.
J. R. Montgomery . . Prest. The J. R. Montgomery Co. . Windsor Locks, Conn. Sept. 29, 1898.
George A. Moody . . . . . 206 Fountain St., Pawtucket, R. I. . . Apr. 27, 1899.
Fred W. Moore . . . Agt. Cordis Mills . . P. O. Box 582, Millbury, Mass. . . . Apr. 27, 1892.
William F. Morgan . . Treas. & Gen. Mgr. Fitchburg Duck Mills . . . . . Fitchburg, Mass. . . Apr. 26, 1906.
George B. Morison . . Prest. Ballou Yarn Co., 77 Summer St., Boston, Mass. . . . . Apr. 24, 1895.
Manley G. Morrill . . . Supt. Attawagan Company, Ballouville, Killingly. Conn. . . Apr. 17, 1908.
Albert H. Morton . . . Supt. Lowell Machine Shop . . . . Lowell, Mass. . . . Oct. 28, 1891.
Harold Mowry . . . . Mgr. Sterling Branch U. S. Finishing Co. . . . . Sterling, Conn. . . . Apr. 27, 1905.
Farquharson J. Muir . Gen. Mgr. Holt-Morgan Mills. . . . Fayetteville, N. C. . . Apr. 27, 1892.
James P. Murray . . . Prest. Toronto Carpet Mfg. Co. . . . . 445 Euclid Ave., Toronto, Ontario, Canada, Apr. 25, 1907.
William Myers . . . . Lecturer in Textiles, Sunny Bank, ... Stone Edge, Marple, Cheshire, England . . . . . Sept. 22, 1904.

John Neild . . . . . Agt. Grinnell Mfg. Corp. . . . . New Bedford, Mass. . Apr. 25, 1901.
Will Nelson . . . . . Supt. Neuse Mills . . . . . Falls, N. C. . . . . Apr. 23, 1903.
Roscius C. Newell . . . Supt. Palmer Mill, Otis Co. . . . . Three Rivers, Mass. . Oct. 25, 1895.
H. W. Nichols . . . . Supt. New Bedford Textile School . New Bedford, Mass. . Sept. 22, 1904.
William A. Nichols . . Supt. Cotton Warp Mill, Hamilton Woolen Co. . . . . Faulkner House, Southbridge, Mass. . Apr. 26, 1906.
William G. Nichols . . Gen. Supt. Maryland Div. Consolidated Cotton Duck Co. . . . . Continental Trust Bldg., Baltimore, Md. . . . Oct. 25, 1893.
Theodore O. Nicholson Treas. Millen Mills, 65 Franklin St., Boston, Mass. . . . . Apr. 25, 1907.

Rene Nicolle . . . . . A. Avicie et Cie Spinning Mill . . . . . .
. . . . . 24 Boulevard Cauchoise, Rouen, France, . . . Oct. 4, 1907.
Albert W. Noone . . . Prop. & Mgr. Jos. Noone's Son's Co. Peterboro, N. H. . . Sept. 26, 1901.
Franklin Nourse . . . Agt. Lawrence Mfg. Co. . . . . Lowell, Mass. . . . Apr. 24, 1878.

S. Odenheimer . . . . Textile Mills Corp. . . . . New Orleans, La. . . Oct. 25, 1893.
Charles K. Oliver . . . Prest. U. S. Consolidated Cotton Duck Company . . .
. . . . . Baltimore, Md. . . . Sept. 27, 1894.
Sewall K. Oliver . . . Asst. to Gen. Mgr. Consolidated Cotton Duck Co. . . . .
. . . . . 809 Continental Trust Bldg., Baltimore Md. . . . Oct. 4, 1907.
Louis Atwell Olney . . Prof. Chemistry & Dyeing, Lowell Textile School . . . .
. . . . . Lowell, Mass. . . . Apr. 26, 1906.
William B. Orr, ... Treas. Forestdale Mfg. Co. . . . . Forestdale, R. I. . . Apr. 28, 1904.
Henry Osgood, ... 6 Monroe St., P. O. Box 204. Salem, Mass. . . . . Apr. 25, 1901.
Frederick Ott . . . . Supt. Lehigh Valley Silk Mills . . . South Bethlehem, Pa. Apr. 23, 1903
Herbert W. Owen . . Supt. Cocheco Mfg. Co. . . . . Dover, N. H. . . . . Oct. 5, 1899.
Logan Owen . . . . Supt. Mill No. 1, Bibb Mfg. Co., . . Macon, Ga. . . . . Apr. 28, 1904.
Oscar L. Owen . . . . Mech. and Mill Eng. Whitin Machine Works . . . . . .
. . . . . P. O. Box 764, Whitinsville, Mass. . Apr. 25, 1894.

Elmer E. Page . . . . Agt. York Manufacturing. Co. . . . Saco, Me. . . . . Apr. 27, 1892.
Calvin D. Paige . . . Treas. Central Mills . . . . . Southbridge, Mass. . Apr. 26, 1906.
Walter H. Paige . . . Supt. Wamsutta Mills Nos. 6 & 7 . . New Bedford, Mass. . Oct. 1, 1903.
O. B. Parker . . . . . 180 Main St., Pawtucket, R. I. . . Apr. 24, 1895.
Samuel L. Parker . . . Supt. Turners Falls Cotton Mills . . . . . .
. . . . . P. O. Box 627, Turners Falls, Mass. . Apr. 29, 1896.
Winthrop Parker . . . Supt. Queen City Cotton Co. . . . . .
. . . . . 54 Bay View St., Burlington, Vt. . . . Sept. 13, 1906.
Samuel F. Patterson . . Treas. and Mgr. Roanoke Mills Co., Roanoke Rapids, N. C. Oct. 18, 1900.
Arthur H. Paul . . . . Asst. Supt. Boston Mfg. Co. . . . . Waltham, Mass. . . . Apr. 27, 1905.
John W. Pead . . . . . 175 Fairmount St., Lowell, Mass. . . . . Apr. 26, 1893.
James R. Pearce . . . Supt. Erwin Cotton Mills . . . . . Duke, N. C. . . . . Oct. 25, 1895.
William E. Peck . . . Agt. The Baltic Mills Co. . . . . Baltic, Conn. . . . . Apr. 26, 1906.
H. M. Peirce . . . . . Agt. Greenwich Bleachery . . . . East Greenwich, R. I. Apr. 26, 1906.
William C. Peirce . . . Prest. Elizabeth Mills 564 Eddy St., Providence, R. I. . . Apr. 24, 1895.
William D. Pennell . . Agt. Hill Mfg. Co. . . . . Lewiston, Me. . . . Apr. 16, 1873.
Haven C. Perham . . . Treas. Kitson Machine Co. . . . . Lowell, Mass. . . . Apr. 30, 1879.
Charles W. Perkins . . Supt. Totokett Mfg. Co. . . . . Versailles, Conn. . . Sept. 21, 1905.
Hadley D. Perkins . . Mgr. Bellingham H'dk'f Mfg. Co., R. F. D. No. 1 . . . .
. . . . . Woonsocket, R. I. . Apr. 28, 1904.
Thomas Perkins, Jr. . . Asst. Supt. Tremont & Suffolk Mills . . . . . .
. . . . . 28 West Bower St., Lowell, Mass. . . . Apr. 25, 1907.
Ramsay Peugnet . . . Sec'y. and Treas. New York Silk Conditioning Works . .
. . . . . 138 Spring St., New York City . . . Apr. 17, 1908.
Aaron C. Phelps . . . Vice Prest. & Gen. Mgr. German-American Co. . . . . .
. . . . . Spray, N. C. . . . . Apr. 26, 1906.

Henry C. Phillips . . . Asst. Gen. Supt. Harmony Mills . . . . . .
. . . . . 46 Vliet St., Cohoes, N. Y. . . . Apr. 25, 1894.
Albert R. Pierce . . . Supt. Pierce Mfg. Corp. . . . . New Bedford, Mass. . Oct. 5, 1899.
Andrew G. Pierce, Jr. . Treas. Pierce Mfg. Corp. . . . . .
. . . . . P. O. Box 34, New Bedford, Mass. . Apr. 24, 1895.
Victor E. Pihl . . . . Mech. Supt. Boott Mills, 869 Bridge St., Lowell, Mass. . . . Apr. 25, 1907.
Robert Place . . . . . Supt. Flint Mills, Fall River, Mass., Supt. Corr Mills,
. . . . . Taunton, Mass., 212 Weybosset St., . Fall River, Mass. . . Apr. 26, 1906.
Charles H. Plummer . . Agt. Great Falls Mfg. Co., ... Somersworth, N. H. Apr. 25, 1888.
Charles T. Plunkett . . Sec'y. Berkshire Cotton Mfg. Co. . Adams, Mass. . . . Apr. 28, 1897.
William B. Plunkett . . Mgr. Berkshire Cotton Mfg. Co. and Mgr. Greylock . .
. . . . . Mills, ... Adams, Mass. . . . Sept. 21, 1905.
William C. Plunkett . . Mgr. W. C. Plunkett & Sons . . . Adams, Mass. . . . Oct. 1, 1903.
Frank Porter, Jr. . . . . Webster, Mass. . . . Apr. 26, 1906.
Charles H. Potter, . . . Supt. Montreal Cotton Co., . . Valleyfield, P. Q., Canada, Apr. 25, 1901.
Joseph H. Potter, Jr. . Supt. Durfee Mills . . . . . Fall River, Mass. . . Apr. 27, 1899.
Albert S. Pratt . . . . Agt. Edwards Mfg. Co. . . . . Augusta, Me. . . . . Apr. 27, 1905.
Herbert L. Pratt . . . . . Lewiston, Me. . . . Oct. 27, 1875.
George E. Prest . . . Supt. Bourne Mills, ... Fall River, Mass. . . Apr. 24, 1902.
John E. Prest . . . . 9 Russell St. . . . . Melrose, Mass. . . . Apr. 17, 1872.
Robert Priebsch . . . . Owner Firm Johann Priebsch Erben, Morchenstern, Post .
. . . . . Tannwald, Bohemia, Austria . . Apr. 17, 1908.

F. J. Quinn . . . . . Agt. Hamilton Woolen Co. . . . . Amesbury, Mass. . . Apr. 26, 1906.

Theodore Ellis Ramsdell, Agt. Monument Mills . . . . . Housatonic, Mass. . Apr. 23, 1903.
M. A. Rawlinson . . . Agt. Chicopee Mfg. Co. . . . . Chicopee Falls, Mass. Apr. 24, 1895.
Theodore S. Raworth . Prest. The Sibley Mfg. Co. . . . . Augusta, Ga. . . . . Oct. 4, 1907.
Joseph G. Ray . . . . Treas. The Putman Mfg. Co. . . . Franklin, Mass. . . . Sept. 13, 1906.
Charles O. Read . . . Mgr. Sayles' Bleacheries, and Treas. Glenlyon Dye Works
. . . . . 63 Summit St. Pawtucket, R. I. . . Sept. 21, 1905.
J. H. Reaney . . . . . Mgr. Royal Gem Mills Co. . . . . St. Johnsville, N. Y. . Apr. 25, 1907.
John F. Reardon . . . Supt. Millville Mfg. Co. . . . . Millville, N. J. . . . Apr. 26, 1900.
Robert Redford . . . . . P. O. Box 28, Lawrence, Mass. . . Apr. 26, 1882.
R. S. Reinhardt . . . . Prest. and Treas. Elm Grove Cotton Mills . . . . . .
. . . . . Lincolnton, N. C. . . Apr. 27, 1898.
T. H. Rennie . . . . . Prest. Pell City Mfg. Co. . . . . Pell City, Ala. . . . Oct. 18, 1900.
Frederic W. Reynolds, Supt. Potomska Mills, Corp. . P. O. Box 299, ...
. . . . . 53 Fourth St., New Bedford, Mass. . Apr. 26, 1900.
Hiram L. Reynolds . . Supt. Saunders Cotton Mills . . . . Saundersville, Mass. . Apr. 25, 1907.
Francis H. Rice . . . . Prest. Holbrook Mills . . . . . Millbury, Mass. . . . Apr. 28, 1880.
John Bion Richards . . . . . 62 Barnaby St., Fall River, Mass. . . Apr. 24, 1902.
Charles H. Richardson . . . . . 156 Methuen St., Lowell, Mass. . . . Apr. 24, 1889.
Charles H. Richardson Jr., Supt. Shove Mills . . . . . Fall River, Mass. . . Apr. 17, 1908.
William Richardson . . Asst. Supt. The Putman Mfg. Co. . . . . .
. . . . . 345 Church St., Putuam, Conn. . . . Apr. 17, 1908.

Harry J. Ricketson . . Supt. Merchants' Mfg. Co. . . . . Fall River, Mass. . Apr. 28, 1904.
Walter Rigby . . . . Supt. Bibb Mfg. Co. . . . . Columbus, Ga. . . . Apr. 26, 1900.
Charles E. Riley . . . C. E. Riley & Co. . . . . .
. . . . . 65 Franklin St., P. O. Box 2815, Boston, Mass. . . . Apr. 25, 1888.
Richard G. Riley . . . Supt. Davol Mills . . . . . Fall River, Mass. . . Apr. 25, 1907.
Benj. H. Roberts . . . General Mill Supplies 163 Grove St., Fall River, Mass. . . Apr. 26, 1900.
George W. Robertson . Supt. Dan River Cotton Mills . . . Danville, Va. . . . . Apr. 26, 1906.
Charles D. Robinson . Supt. Crompton Co. . . . . Crompton, R. I. . . . Sept. 27, 1894.
William H. Robinson . Supt. Brighton Mills . . . . . Passaic, N. J. . . . . Apr. 24, 1902.
John J. Rooney . . . Asst. Supt. Tremont & Suffolk Mills . . . . . .
. . . . . 151 Cabot St., Lowell, Mass. . . . Apr. 27, 1905.
W. H. Rose . . . . . Asst. Treas. Olympia Cotton Mills, . Greenville, S. C. . . Oct. 18, 1900.
James H. Ross . . . . Firm John L. Ross & Son . . . . . .
. . . . . 184 Church St., Willimantic, Conn. . Apr. 17, 1908.
John H. Ross . . . . Treas. R. W. Lord Co. . . . . .
. . . . . 575 Atlantic Ave., Boston, Mass. . . . Apr. 17, 1908.
Israel P. Rounds . . . Supt. Naushon Co., 20 Maynard St., Pawtucket, R. I. . . Apr. 26, 1906.
Henry Rowe . . . . . Supt. Elk Mountain Bleachery . . . Asheville, N. C. . . Apr. 28, 1904.
David A. Russell . . . Gen. Mgr. Windsor Print Works . . North Adams, Mass. . Oct. 4, 1907.

Alfred Sagar . . . . . Supt. Arlington Mill's Cotton Department . . . . . .
. . . . . 6 Stevens St., Methuen, Mass. . . Apr. 24, 1902.
Edward H. Sanborn . . Vice Prest. Cold Spring Bleaching and Finishing Works .
. . . . . 305 Betz Bldg., Philadelphia, Pa. . . Oct. 18, 1900
W. K. Sanborn . . . . Supt. R. W. Lord Co. . . . . West Kennebunk, Me., Apr. 25, 1907.
J. N. Sanderson . . Agt. Renfrew Mfg. Co., ... Adams, Mass. . . . Apr. 28, 1904.
Arnold B. Sanford . . Prest. Amer. Cotton Yarn Exchange . . . . . .
. . . . . 67 Chauncy St., Boston, Mass. . . . Oct. 25, 1882.
Pardon B. Sanford . . Gen. Supt. New York Mills . . . . . .
. . . . . New York Mills, Oneida County, N. Y., Oct. 2, 1902.
J. Herbert Sawyer . . . . . 147 Milk St., Boston, Mass. . . . July 19, 1865.
Frank A. Sayles . . . Prop. Sayles' Bleacheries, Prest. Lorraine Mfg. Co. . . .
. . . . . Pawtucket, R. I. . . Apr. 26, 1906.
Arnold Schaer . . . . Agt. Warren Mfg. Co. . . . . Warren, R. I. . . . Apr. 24, 1895.
Albert E. Schofield . . Treas. Delph Spinning Co. . . . . .
. . . . . Clearfield and C Sts., Philadelphia, Pa. . . Oct. 1, 1903.
Robert Schofield . . . Supt. New England Cotton Yarn Co., ...
. . . . . P. O. Box 380, New Bedford, Mass. Apr. 25, 1907.
Winfield S. Schuster . . Vice Prest. Forestdale Mills . . . . East Douglas, Mass. . Apr. 25, 1907.
Theodore C. Search . . Prest. Cold Spring Bleaching and Finishing Works . . .
. . . . . Yardley, Pa. . . . . Oct. 18, 1900.
Albion K. Searls . . . Supt. Yarn Dept., Oneita Knitting Mills . . . . . .
. . . . . 195 Elizabeth St., Utica, N. Y. . . . . Apr. 24, 1902.
Charles M. Sears . . . Supt. Monroe Cotton Mills . . . . Monroe, Ga. . . . . Apr. 27, 1898.
George H. Shapley . . Treas. Silver Lake Co., 78 Chauncy St. . . . . .
. . . . . Boston, Mass. . . . . Apr. 29, 1896.

Frank P. Sheldon . . . Mill Engineer and Architect, 49 Westminster St. . . . . .
. . . . . Industrial Trust Bldg. Providence, R. I. . . Apr. 25, 1894.
Thomas C. Sheldon . . Mech. & Mill Eng. . . 8 School St., Fitchburg, Mass. . . Oct. 29, 1884.
Charles W. Shepard . . Lace Mfr. . . . . Alton, R. I. . . . . Sept. 21, 1905.
Willis S. Shepard . . . Vice Prest. American Net and Twine Co. . . . . .
. . . . . 575 Atlantic Ave., Boston, Mass. . . . Apr. 29, 1896.
Edwin G. Shepardson . Supt. Kilburn Mill . . . . . New Bedford, Mass. Apr. 25, 1907.
William F. Sherman . . Mill Engineer, 88 Broad St., Room 626, Boston, Mass. .
. . . . . Res. 128 Youle St., Melrose, Mass. . . Apr. 15, 1874.
Charles M. Shove . . . Treas. Granite Mills . P. O. Box 45, Fall River, Mass. . . Oct. 27, 1875.
W. Frank Shove . . . Treas. Pocasset Mfg. Co., Treas. Fall River Mfg. Co., . . .
. . . . . Fall River, Mass. and Treas. Windham Mfg. Co., . . .
. . . . . Willimantic, Conn. . . . . Fall River, Mass. . . Sept. 22, 1904.
Herbert H. Shumway . . . . . Chestnut St., Taunton, Mass. . . . Apr. 26, 1893.
Francis H. Silsbee . . Supt. Cotton Dept., Pacific Mills . . Lawrence, Mass. . . Apr. 7, 1887.
Nathaniel G. Simonds . Treas. Naumkeag Steam Cotton Co., Salem, Mass. . . . . Apr. 27, 1898.
Louis Simpson . . . . Gen. Mgr. Montreal Cotton Co. . Valleyfield, P.Q., Canada, Apr. 24, 1895.
John Skinner . . . . Asst. Treas. West Boylston Mfg. Co., Easthampton, Mass. Apr. 26, 1906.
Abbott E. Slade . . . Treas. Laurel Lake Mills . . . . . .
. . . . . 863 High St., Fall River, Mass. . . Oct. 25, 1893.
Archer J. Smith . . . Treas. The American Mills Co. . . Waterbury, Conn. . Apr. 26, 1906.
Arthur T. Smith . . . Supt. Langley Mfg. Co. and Supt. Aiken Manufg. Co. . .
. . . . . Langley, S. C. . . . Oct. 25, 1895.
Henry Kay Smith . . . Partner Jamestown Cotton Mill . . Jamestown, N. Y. . . Oct. 4, 1907.
James Herbert Smith . Supt. Quinebaug Co. . . . . Danielson, Conn. . . Apr. 27, 1898.
Joel Smith . . . . . 1311 Woodlawn Ave. . . . . Augusta, Ga. . . . . Oct. 25, 1895
J. C. Smith . . . . . Supt. Chace Mills . . . . . Fall River, Mass. . . Oct. 28, 1897.
John William Smith . . Gen. Mgr. T. I. Birken & Co. . . . Chester, Pa. . . . . Sept. 21, 1905.
Robert A. Smith . . . Asst. Supt. Mass. Cotton Mills . . . . . .
. . . . . P. O. Box 1230, Lowell, Mass. . . . . Apr. 25, 1907.
Stephen E. Smith . . . Instr. Cotton Spinning, Lowell Textile School, ...
. . . . . Lowell, Mass. . . . . Apr. 27, 1905.
Thomas Henry Smith . Partner Jamestown Cotton Mill . . Jamestown, N. Y. . . Apr. 30, 1884.
W. H. Smith . . . . . Supt. American Textile Co. . . . . .
. . . . . 625 East Ave., Pawtucket, R. I. . . Sept. 21, 1905.
Rufus A. Soule . . . Prest. Soule Mill and Prest. City Mfg. Corp. . . . . .
. . . . . New Bedford, Mass. . Apr. 28, 1904.
Rufus A. Soule, Jr. . . Cotton Goods Broker, W. L. Heineman & Co. . . . . .
. . . . . 236 Church St., New York City . . . Apr. 26, 1906.
William S. Southworth . Agt. Mass. Cotton Mills . . . . . .
. . . . . P. O. Box 1230, Lowell, Mass. . . . Oct. 31, 1888.
Antonio Spencer . . . Prest. Spencer Yarn Co. . . . . .
. . . . . 337 Butler Exchange, Providence, R. I. . . Sept. 21, 1905.
Wilton H. Spencer . . Textile Mfr., . . . 7 Exchange Pl., Providence, R. I. . Apr. 27, 1898.
George E. Spofford . . Supt. Blackstone Mfg. Co. . . . . Blackstone, Mass. . . Apr. 29, 1896.
Alban Spooner . . . . Prest. Beverly Underwear Co. . . . Beverly, N. J. . . . Sept. 21, 1905.

Henry B. Sprague . . Treas. Boston Woven Hose and Rubber Co. . . . . .
. . . . . Lynn, Mass. . . . . Oct. 5, 1899.
Leroy Springs . . . . Prest. Lancaster Cotton Mills . . . Lancaster, S. C. . . Oct. 25, 1895.
George R. Stearns . . Prest. and Treas. Riverside Mills . Augusta, Ga. . . . . Apr. 30, 1890.
Willard W. Stearns . . Supt. Nos. 1 & 3 Farr Alpaca Co. . . . . .
. . . . . 224 Pine St., Holyoke, Mass. . . . Sept. 13, 1906.
Dexter Stevens . . . . Supt. Yarn Dept. Lancaster Mills . . Clinton, Mass. . . . Apr. 25, 1907.
John A. Stevens . . . Chief Engineer, Merrimack Mfg. Co. . . . . .
. . . . . 78 Hanks St., Lowell, Mass. . . . Apr. 25, 1907.
T. B. Stevenson . . . . Supt. Manchaug Co. . . . . Manchaug, Mass. . . Apr. 26, 1900.
William M. Stevenson . Supt. Hodges Fibre Carpet Co. . . . Indian Orchard, Mass., Apr. 25, 1907.
Robert Stewart . . . . Supt. Ashton Mills, Lonsdale Co. . Ashton, R. I.. . . . Apr. 27, 1899.
Samuel Stewart . . . . Supt. Boston Duck Co. . . . . Bondsville, Mass. . . Apr. 23, 1903.
William J. Stewart . . Supt. S. Slater & Sons, Inc. . . . . Webster, Mass. . . . Apr. 23, 1903.
Walter F. Stiles . . . Treas. Orswell Mills . . . . . Fitchburg, Mass. . . Oct. 25, 1895.
O. W. Stites . . . . . Supt. Louisville Cot. Mills Co. . . . Louisville, Ky. . . . Oct. 25, 1895.
Thomas Stone . . . . . 141 Bonney St., New Bedford, Mass. . Apr. 25, 1907.
B. L. Stowe . . . . . Prest. Eureka Fire Hose Mfg. Co. . . . . .
. . . . . Wilkinson and Arlington Aves., Jersey City, N. J. . . Sept. 26, 1901.
Herman F. Straw . . . Agt. Amoskeag Mfg. Co. and Agt. Manchester Mills. . . .
. . . . . Manchester, N. H. . . Oct. 28, 1885.
William Parker Straw . Gen. Mfg. Supt. Amoskeag Mfg. Co. Manchester, N. H. . . Oct. 4, 1907.
John B. Strongman . . Treas. Gosnold Mills Co. . . . . New Bedford, Mass. . Apr. 25, 1907.
John Sullivan . . . . Care C. E. Riley & Co., ...
. . . . . 65 Franklin St. Boston, Mass. . . . Apr. 27, 1899.
Timothy Sullivan . . . Supt. Stafford Mills . . . . . Fall River, Mass. . . Apr. 27, 1899.
Walter H. Summersby . Agt. Atlantic Cotton Mills . . . . Lawrence, Mass. . . Oct. 25, 1893.
James O. Sweet . . . . Agt. and Treas. Ashland Cotton Co. Jewett City, Conn. . Apr. 28, 1886.

Frederic Taber . . . . Prest. Taber Mill . . . . . New Bedford, Mass. Apr. 26, 1906.
Charles A. Tabor . . . Agt. Thorndike Co. . . . . Thorndike, Mass. . . Apr. 27, 1905.
Robert W. Taft . . . . Treas. Coventry Co., P. O. Box 1144, Providence, R. I. . . Sept. 27, 1894.
Narazo Takatsuji . . . Dir. and Gen. Supt. The Kanegafuchi Cotton Spinning Co.
. . . . . Tokio, Japan . . . . Apr. 17, 1908.
John Lincoln Tattersall, Director Robert Hyde Buckley & Sons, Ltd. . . . . .
. . . . . 69 Royal Exchange, Manchester, Eng. . . Apr. 25, 1907.
H. P. Taveira . . . . . Mgr. Compantia Fabril Lisboneuse . . . . . .
. . . . . 236 Rua da Palma, Lisboa, Portugal . . Apr. 17, 1908.
James W. Taylor . . . Agt. Field & Hatch Knitting Co. . . . . .
. . . . . P. O. Box 144, Cohoes, N. Y. . . Oct. 26, 1892.
Samuel Taylor . . . . Supt. Soule Mill . . . . . New Bedford, Mass. . Oct. 1, 1903.
W. Marshall Taylor . . Supt. Oxford Linen Mills . . North Brookfield, Mass. . . Sept. 22, 1896.
Edward Thayer . . . . Sec'y Lebanon Mill Co. . . . . Pawtucket, R. I. . . Sept. 21, 1905.
S. Willard Thayer . . . Treas. Dexter Yarn Co. . . . . Pawtucket, R. I. . . Sept. 26, 1901.
Berton A. Thissell . . . . . 314 Ninth St., N. W., Washington, D. C. . Oct. 1, 1903.
Earl A. Thissell . . . . Treas. Lowell Hosiery Co. . . . . Lowell, Mass. . . . Oct. 30, 1878.

Ariel C. Thomas . . . Agt. Boott Cotton Mills . . . . . .
. . . . . 62 Mt. Vernon St., Lowell, Mass. . . . Oct. 31, 1888.
Arthur S. Thomas . . . Asst. to Gen. Mgr. Consolidated Cotton Duck Co. . . . .
. . . . . 111 Stevens St., Lowell, Mass. . . . . Oct. 4, 1907.
Charles E. Thomas . . Supt. . . . . Pontiac, R. I. . . . . Oct. 31, 1883.
Edward W. Thomas . . Gen. Mgr. Consolidated Cotton Duck Co. . . . . .
. . . . . 809 Continental Trust Bldg., Baltimore, Md. . . . Apr. 30, 1884.
James O. Thompson, Jr. Supt. Wampanoag Mills . . . . . Fall River, Mass. . . Oct. 18, 1900.
Charles R. Thomson . Supt. Renfrew Mfg. Co. . . . . Adams, Mass. . . . Apr. 27, 1905.
James Thomson . . . Asst. Mgr. Dwight Mfg. Co. . . . . .
. . . . . 53 State St., Boston, Mass. . . . . Apr. 25, 1907.
Ralph E. Thomson . . Supt. Parkhill Mfg. Co., Mill C. . . Fitchburg, Mass. . . Apr. 25, 1894.
Richard Thomson . . . Gen. Mgr. Penmans, Ltd., Paris, Province of Ontario, Canada, Oct. 4, 1907.
R. Irving Tobey . . . . . Lonsdale, R. I. . . . Oct. 2, 1902.
W. O. Todd . . . . . P. O. Box 31, Essex St. Station, Boston, Mass. . . Oct. 18, 1900
James P. Tolman . . . Prest. Samson Cordage Works . . . . . .
. . . . . 88 Broad St., Boston, Mass. . . . Oct. 29, 1890.
Daniel A. Tompkins . Prest. and Eng. D. A. Tompkins Co. Charlotte, N. C. . . . Oct. 25, 1895.
M. J. Toohey . . . . Mfr. Rope, Twine and Banding . . . . . .
. . . . . 809 Stafford Rd., Fall River, Mass. . . Oct. 2, 1902.
George W. Towne . . . Mgr. Bibb Mfg. Co. Columbus Mill, Columbus, Ga. . . .
. . . . . 62 Salem St., North Andover, Mass. Oct. 26, 1892.
Edward B. Townsend . Treas. Warwick Mills . . . . . .
. . . . . 27 Kilby St., Boston, Mass. . . . Apr. 25, 1901.
George M. Traber . . Mgr. The Perry Knitting Co. . . . Perry, N. Y. . . . . Sept. 13, 1906.
D. Irving Trainer . . . Agt. Lincoln Mfg. Co. . . . . Chester, Pa. . . . . Apr. 23, 1903.
Robert B. Treat . . . . Prest. and Treas. Manufacturers Fuel Co. of Rhode Island .
. . . . . 1032 Banigan Bldg., Providence, R. I. . . Sept. 27, 1894.
W. S. Trickett . . . . Supt. Esmond Mills . . . . . Enfield, R. I. . . . . Sept. 21, 1905.
C. H. Truesdell . . . . Supt. Attawaugan Co. . . . . Killingly, Conn. . . Oct. 29, 1884.
Frank S. Tucker . . . Salesman, Westinghouse Elec. & Mfg. Co. . . . . .
. . . . . 507 Trust Bldg., Charlotte, N. C. . . . Apr. 26, 1906.
George E. Tucker . . . Agt. Otis Co. . . . . Ware, Mass. . . . . Oct. 25, 1895.
Philip S. Tuley . . . Prest. and Treas. Louisville Cotton Mills Co. . . . . .
. . . . . Goss Ave. and McHenry St., Louisville, Ky. . . . Oct. 18, 1900.
Harry Tunstall . . . . Supt. Wm. Clark Mills American Thread Co. . . . . .
. . . . . Westerly, R. I. . . . Sept. 21, 1905.
George W. Turner . . . . . Gloucester City, N. J. Apr. 26, 1900.
William L. Turner . . Prest. North American Lace Co. . . . . .
. . . . . Eighth and Allegheny Ave., Philadelphia, Pa. . . Sept. 21, 1905.
William D. Twiss . . . Supt. Everett Mills . . . . . Lawrence, Mass. . . April 29, 1896.

Frederich Uebel . . . Mem. Firm Gebruder Uebel Netzschkau ü. Adorf . . . .
. . . . . Plauen, Saxony, Germany . . Apr. 17, 1908.
Fenwick Umpleby . . Instr. Lowell Textile School . . . . Lowell, Mass. . . . Apr. 27, 1905.
Fred Unger . . . . . 48 Central St., Providence, R. I. . . Apr. 26, 1906.
Frederick A. Upham . Asst. Supt., Palmer Mill of the Otis Co. Three Rivers, Mass. . Sept. 13, 1906.
Charles T. Upton . . . . . 63 Mt. Vernon St., Lowell, Mass. . . . Apr. 28, 1897.

George A. Vaughan . . Supt. The Putnam Mfg. Co. . . . . Putnam, Conn. . . . Sept. 22, 1896.
William P. Vaughan . Agt. Putnam The Mfg. Co. . . . . .
. . . . . 1041 Banigan Building, Providence, R. I. . . Sept. 29, 1898.

Jude C. Wadleigh . . . Agt. Merrimack Mfg. Co. . . . . Lowell, Mass. . . . Oct. 26, 1892.
Herbert E. Walmsley . Agt. Wamsutta Mills . . . . . New Bedford, Mass. . Oct. 29, 1890.
Robinson Walmsley . . Supt. Tecumseh Mills, P. O. Box 246, Fall River, Mass. . . Apr. 27, 1899.
Frederick T. Walsh . . . . . 12 Valentine St., West Newton, Mass. . Apr. 28, 1897.
Joseph Wasserman . . Prest. Philadelphia Tapestry Mills, ...
. . . . . Allegheny Ave. and Front St. Philadelphia, Pa. . . Apr. 26, 1906.
Frederick E. Waterman Treas. Stafford Mills and Treas. Cornell Mills, ...
. . . . . Fall River, Mass. . . Sept. 22, 1904.
Joseph Watters . . . . Supt. Osborn Mills . . . . . Fall River, Mass. . . Oct. 15, 1873.
F. E. Wattles . . . . Agt. Boscawen Mills . . . . . Penacook, N. H. . . Oct. 5, 1899.
Ridley Watts . . . . . Commission Merchant Grinnell Willis & Co. . . . . .
. . . . . 44 Leonard St., New York City . . . Apr. 25, 1907.
Berthrand A. Webber . . Supt. Nottingham Mill, 314 Dyer St., Providence, R. I. . . Apr. 17, 1908.
William R. West . . . Prest. Mt. Pleasant Banding Corp. . . . . .
. . . . . 830 Purchase St., New Bedford, Mass. . Sept. 22, 1896.
Wm. T. Westerman . . Mgr. Ontario Spinning Co. . . . . .
. . . . . 1729 Philip St., Philadelphia, Pa. . . Oct. 1, 1903.
W. B. Smith Whaley . Mechanical & Mill Engineer, ...
. . . . . 1012 Tremont Bldg., Boston, Mass. . . . Apr. 24, 1895.
Walter Whipple . . . Asst. Supt. Nashua Mfg. Co. . . . Nashua, N. H. . . . Sept. 13, 1906.
Channing Whitaker . . Infringement and Patentability of Inventions . . . . . .
. . . . . Lowell Machine Shop . . . . . Lowell, Mass. . . . Oct. 15, 1873.
James L. Whitaker . . Mgr. William Whitaker & Sons, 308 Mariners and Merchants
. . . . . Bldg., Third and Chestnut Sts., Philadelphia, Pa. . . Sept. 21, 1905.
A. Tenny White . . . Supt. Manville Co. . . . . Manville, R. I. . . . Oct. 27, 1887.
Alphonso F. White . . Supt. Forestdale Mfg. Co., ... Forestdale, R. I. . . Apr. 24, 1902.
John H. White . . . . Supt. Edwards Mfg. Co. . . . . Augusta, Me. . . . . Apr. 17, 1908
W. T. Whitehead . . . Mgr. The Mount Royal Spinning Co., Ltd., ...
. . . . . Montreal P. Q., Canada, Apr. 26, 1906.
Arthur F. Whitin . . . Prest. Saunders Cotton Mills . . . Whitinsville, Mass. . Apr. 24, 1895.
Fred B. Whitin . . . . Agt. Uxbridge Cotton Mills . . . North Uxbridge, Mass., Apr. 28, 1897.
Henry T. Whitin . . . Treas. Paul Whitin Mfg. Co. . . . . Northbridge, Mass. . Apr. 25, 1877.
James Earle Whitin . . Treas. Uxbridge Cotton Mills . . . North Uxbridge, Mass., Apr. 23, 1903.
Paul Whitin . . . . . Asst. Treas. Paul Whitin Mfg. Co. . Northbridge, Mass. . Oct. 1, 1903.
Clarence Whitman . . Treas. Wilkesbarre Lace Mfg. Co. . . . . .
. . . . . 39-41 Leonard St., New York City . . . Apr. 26, 1906.
Harold C. Whitman . . Treas. Esmond Mills, 39 Leonard St., New York City . . . Apr. 25, 1907.
William Whitman . . Prest. Arlington Mills, Lawrence, Prest. Whitman Mills,
. . . . . New Bedford, Prest. Nonquit Spinning Co., New Bedford,
. . . . . Prest. Manomet Mills, New Bedford, ...
. . . . . 78 Chauncy St. P. O. Box 100, Essex St. Station, ...
. . . . . Boston, Mass. . . . . Apr. 25, 1901.

William S. Whitney . . Supervising Engineer, American Woolen Co. . . . . Lawrence, Mass. . . Apr. 24, 1878.
John G. Whittaker . . Supt. Glenlyon Dye Works . . . . Saylesville, R. I. . . Apr. 17, 1908.
Arthur Whittam . . . N. Y. Representative James E. Mitchell Co. . . . . 73 Leonard St., New York, N. Y. . . Apr. 27, 1898.
George F. Whitten . . Agt. Suncook Mills, Suncook, N. H., Manchester, N. H. . Oct. 26, 1892.
John H. Whitten . . . Wellington, Sears & Co., 202 Devonshire St., Boston, Mass- . . . . . Manchester, N. H. . Apr. 27, 1898.
W. R. B. Whittier . . Treas. Whittier Mills, Chattahoochee, Fulton County, Ga. . Oct. 18, 1900.
George A. Wies . . . . Treas. Eureka Fire Hose Mfg. Co. . . . . 13 Barclay St., New York City . . . Apr. 24, 1902.
Edward B. Wilbur . . Vice Prest. & Supt. Mollohon Mfg. Co. Newberry, S. C. . . . Oct. 30, 1889.
Benjamin Wilcox . . . Treas. City Mfg. Co. . . . . New Bedford, Mass. . Apr. 26, 1900.
John B. Wild . . . . Prest. Oneita Knitting Mills . . . . . 842 Bleecker St., Utica, N. Y. . . . . Apr. 26, 1900.
Paul C. Wilde . . . . Supt. Middlesex Bleach Dye and Print Works . . . . . 3 Harding Ave., Waltham, Mass. . . . Apr. 17, 1908.
E. Wilkinson, Jr. . . . Member Firm of E. Wilkinson & Son . . . . . Amber and Adams Sts., Philadelphia, Pa. . . Sept. 13, 1906.
Arthur L. Willey . . . Asst. Supt. Grant Yarn Co. . . . . 41 Arlington St., Fitchburg, Mass. . . Apr. 17, 1908.
Eben C. Willey . . . . Supt. Barnaby Mfg. Co. . . . . 110 June St., Fall River, Mass. . . Apr. 29, 1896.
Eugene F. Willey . . . Supt. Globe Yarn Mills . . . . . Fall River, Mass. . . Sept. 13, 1906.
Franklin D. Williams . Asst. Treas. Hamilton Mfg. Co. . . 70 Kilby St. Room 48, ... Boston, Mass. . . . . Apr. 25, 1901.
Henry Williams . . . Supt. Ipswich Mills . . . . . Ipswich, Mass. . . . Apr. 23, 1903.
Broadus E. Willingham, Sec'y. and Treas. Willingham Cotton Mills . . . . . Macon, Ga. . . . . Oct. 18, 1900.
Elias S. Willis . . . . Supt. New England Cotton Yarn Co., Taunton, Mass. . . Apr. 23, 1903.
Merton J. Wilmarth . . Supt. J. L. & T. D. Peck Mfg. Co. . . . . 44 Myrtle St., Pittsfield, Mass. . . . Apr. 25, 1907.
George A. Wilson . . . Supt. Whitman Mills, 171 Davis St., New Bedford, Mass. . Apr. 25, 1907.
Newton Wilson . . . . Supt. Samson Cordage Works . . . Shirley, Mass. . . . Apr. 25, 1907.
R. L. Wilson . . . . . Gen. Mgr. Floyd Cotton Mills . . . Rome, Ga . . . . . Apr. 25, 1907.
William E. Winchester . Deering, Milliken & Co. . . . . 79-83 Leonard St., New York, N. Y. . . Apr. 24, 1902.
Samuel F. Winsper . . Supt. Bennett Dept., New England Cotton Yarn Co., ... Mills 1, 2, 3, 4, . . 226 Grinnell St., New Bedford, Mass. . Apr. 23, 1903.
Rex G. Witherbee . . Asst. Supt. Utica Steam and Mohawk Valley Cotton Mills . . . . . Utica, N. Y. . . . . Apr. 26, 1906.
Charles W. Wood . . . Mills Mgr. Consolidated Cotton Duck Co. Hampden, ... Baltimore, Md. . . . Sept. 21, 1905.
George Wood . . . . Prest. and Treas. Millville Mfg. Co. . . . . 626 Chestnut St., Philadelphia, Pa. . . Oct. 16, 1872.
John P. Wood . . . . William Wood & Co., 521 N. 22d St., Philadelphia, Pa. . . Apr. 28, 1897.
Kenneth F. Wood . . Supt. Sayles Bleacheries . . . . . Sayesville, R. I. . . . Sept. 13, 1906.

Oscar W. Wood . . . Treas. Germantown Spinning Co. . . . . .
. . . . . High St., Germantown, Philadelphia, Pa. . . Oct. 18, 1900.
William P. Wood . . . Supt. The Jenckes Spinning Co. . . Pawtucket, R. I. . . Apr. 26, 1906.
Marcus J. Woodrow . . Supt. Clinton Mfg. Co., 93 Clinton St., Woonsocket, R. I. . Apr. 26, 1906.
George A. Woodward . Prest. & Gen. Mgr. Rockland Webbing Co. . . . . .
. . . . . Rockland, Mass. . . Oct. 4, 1907.
Wm. I. Woodward . . Agt. Shetucket Co. . . . . Norwich, Conn. . . Apr. 23, 1903.
Frank F. Woolley . . . Supt. Coventry Co. . . . . Anthony, R. I. . . . Apr. 27, 1905.
George W. Wright . . Supt. Shove Mills . 590 Locust St., Fall River, Mass. . . Apr. 26, 1906.

Adelbert R. Young . . Supt. Ashland Cotton Co. . . . . Jewett City, Conn. . . Apr. 25, 1894.
James M. Young . . . Mgr. Hamilton Cotton Co. . . . . Hamilton, Ont., Can. Apr. 27, 1899.

George E. Zellers . . . Mgr. John Farnum & Co., Nos. 2 and 3 Mills . . . . . .
. . . . . 214 South Prince St., Lancaster, Pa. . . . Apr. 25, 1907.

ASSOCIATE MEMBERS.

Eugene C. Andres . . Fr. Jac. Andres, Inc. . . . . .
. . . . . 127 Federal St., Room 36, Boston, Mass. . . . Oct. 18, 1900.
Henry Ashworth . . . Ashworth Bros. . . . . .
. . . . . 89 Globe Mills Ave., P O. Box 427, Fall River, Mass. . . Apr. 28, 1897.
George R. Babbitt . . . Prest. and Gen. Mgr. American Oil Co. and Prest. and Treas.
. . . . . The Burke Eng. Co., 182 So. Water St., Providence, R. I. . Apr. 24, 1895.
Harry Gage Baker . . Sales Manager, Stafford Company . . . . . .
. . . . . Res. 656 Main St., Worcester, Mass. . . Sept. 21, 1905.
Edwin Barnes . . . . Vice Prest. Wm. Firth Co. . . . . .
79 Milk St., Boston, Mass. . . . . Apr. 26, 1900.
George S. Barnum . . Vice Prest. The Bigelow Co. . . . New Haven, Conn. . Apr. 24, 1895.
Colin C. Bell . . . . Vice-Prest. American Vulcanized Fibre Co. . . . . .
. . . . . 12 Pearl St., Boston, Mass. . . . Apr. 29, 1896.
Frank P. Bennett . . . Publisher American Wool and Cotton Reporter . . . . .
. . . . . 530 Atlantic Ave., Boston, Mass. . . . Sept. 22, 1896.
Edward H. Best . . . Woolen Merchant, 224 Purchase St., Boston, Mass. . . Apr. 23, 1903.
Albert Birch . . . . . Prop. & Mgr. Birch Bros. Co., ...
. . . . . 32 Kent St., Somerville, Mass. . . Oct. 2, 1902.
Arthur Birch . . . . . Prop. and Mgr. Arlington Machine Works . . . . . .
. . . . . Arlington Heights, Mass. . . Oct. 4, 1907.
Frederick H. Bishop, . Gen. Mgr. Universal Winding Co. . . . . .
. . . . . 95 South St., Boston, Mass. . . . . Apr. 26, 1900.
Edmund E. Blake . . Agt. Saco & Pettee Machine Shops . . . Biddeford, Me. . Oct. 2, 1902.
Charles A. Bowen . . Treas. & Gen. Mgr. S. C. Lowe Supply Co. . . . . .
. . . . . 87 Union St., New Bedford, Mass. . Apr. 26, 1906.

Artnur T. Bradlee . . Mem. firm Harding, Whitman & Co . . . . . .
. . . . . 78 Chauncy St., Boston, Mass. . . . . Apr. 25, 1901.
J. Frank Braids . . . . Vice Prest. Charles S. Bush Co. . . . . .
. . . . . P. O. Box 20, 212 Weybosset St., Providence, R. I. . . Apr. 28, 1897.
Samuel N. Braman . . Engineer Westinghouse Machine Co. . . . . .
. . . . . 131 State St., Boston, Mass. . . . Apr. 27, 1905.
James H. Brand, Jr. . . Cotton Broker . . . . . .
. . . . . 201 Board of Trade Building, Montreal, P. Q., Canada . . . Sept. 13, 1906.
Henry Gordon Brinckerhoff, New Englnnd Mgr. Green Fuel Economizer Co., . . .
. . . . . Room 701 Oliver Building, 141 Milk St., . Boston, Mass. . . . Sept. 22, 1896.
Harry S. Brown . . . New England Mgr. Power Specialty Co. . . . . .
. . . . . 10 Postoffice Square, Boston, Mass. . . . Sept. 21, 1905.
H. Martin Brown . . . Treas. U. S. Bobbin & Shuttle Co. . Providence, R. I. . . Apr. 24, 1895.
George L. Brownell . . Inventor and Builder of Improved Twisting Machinery . .
. . . . . 49 Union St., Station A, Worcester, Mass. . . Apr. 23, 1903.
Percy H. Brundage . . . . . 49 Wall St., New York, N. Y. . . Oct. 5, 1899.
W. Irving Bullard . . . Vice President, E. H. Jacobs Mfg. Co., ...
. . . . . Danielson, Conn. . . Apr. 25, 1907.
John H. Burghardt . . Page Belting Co. . . . 31 Pearl St., Boston, Mass. . . . Apr. 24, 1895.
Charles B. Burleigh . . Textile Power Dept., General Electric Co. . . . . .
. . . . . 84 State St., Boston, Mass. . . Oct. 1, 1903.
Eugene E. Burnham . . Belt Mfr. . . . . 252 Lowell St., Lawrence, Mass. . . Oct. 25, 1895.
Hermon N. Burpee . . Gen. Sales Mgr., Barber-Colman Co. . . . . .
. . . . . 77 Washington St., North, Boston, Mass. . . . Sept. 13, 1906.
Arthur Cecil Butler . . Agt. for E. A. Leigh, ... 232 Summer St. Boston, Mass. Apr. 28, 1904.
Harry W. Butterworth . Sec'y. H. W. Butterworth & Sons . . . . . .
. . . . . York and Cedar Sts., Philadelphia, Pa. . . Oct. 28, 1897.
James Butterworth . Prest. H. W. Butterworth & Sons . . . . . .
. . . . . York and Cedar Sts., Philadelphia, Pa. . . Apr. 24, 1895.

L. W. Campbell . . . Agt. Woonsocket Machine & Press Co. . . . . .
. . . . . Woonsocket, R. I. . . Sept. 22, 1904.
Malcolm Campbell . . Gen. Mgr. Woonsocket Machine and Press Co. . . . . .
. . . . . Woonsocket, R. I. . . Apr. 24, 1895.
W. W. Carey . . . . . Mfr. Wood Rim Pulleys and Wood Working Machinery . .
. . . . . 514 Broadway, Lowell, Mass. . . . . Apr. 24, 1895.
P. N. Caridia . . . . . Choremi, Benachi & Co., 53 State St., Boston, Mass. . . . . Oct. 4, 1907.
Chas. F. Chase . . . Eastern Mgr. Cling Surface Co., of Buffalo . . . . . .
. . . . . 39 Cortlandt St., New York, N. Y. . Sept. 21, 1905.
J. E. Cheesman . . . . Prest. Cheesman Cotton Gin Co. . . . . .
. . . . . 76 William St., New York, N. Y. . . Oct. 5, 1899.
Frederic A. Chase . . Treas. National Ring Traveler Co. . . . . .
. . . . . 257 West Exchange St., Providence, R. I. . . Apr. 24, 1895.
Charles H. Child . . . Treas. Standard Mill Supply Co. . . . . .
. . . . . P. O. Box 1426, 39 Exchange Place, Providence, R. I. . . Apr. 24, 1895.

Thomas J. Clexton . . Mgr. A. Klipstein & Co. . . . . .
. . . . . 285 Congress St. Boston, Mass. . . . Sept. 13, 1906.
Melvin H. Coffin . . . Selling Agt. Whitin Machine Works Whitinsville, Mass. . Oct. 2, 1902.
Howard D. Colman . . Prest. and Treas. Barber-Colman Co. Rockford, Ill. . . . Apr. 27, 1905.
James A. Cooper . . . Whitin Machine Works . . . . . Whitinsville, Mass. . Sept. 13, 1906.
Charles C. Cowan . . . Cotton Merchant, The Tontine Bldg., Room 1106, ...
. . . . . 82 Wall St., New York, N. Y. . . Oct. 5, 1899.
Thomas G. Cox . . . . Selling Agt. Mason Machine Works . . . . . .
. . . . . P. O. Box 316, Taunton, Mass. . . . Apr. 24, 1895.
Stuart W. Cramer . . . Southern Agt., The Whitin Machine Works and of . . .
. . . . . Woonsocket Machine & Press Co., Charlotte, N. C. . . Apr. 26, 1906.
Randolph Crompton . . Mem. Firm of Crompton-Thayer Loom Co. . . . . .
. . . . . Worcester, Mass. . . Oct. 28, 1897.
C. F. Curwen . . . . Treas. Dinsmore Mfg. Co. . . . . Salem, Mass. . . . . Apr. 27, 1899.
Joseph L. Cushing . . Prop. Daniel Cushing & Co., ...
. . . . . P. O. Box 885, Lowell, Mass. . . . Apr. 26, 1900.

Frederick I. Dana . . . Gen. Sales Mgr., The Textile Finishing Machinery Co. . .
. . . . . Howard Bldg., 83 Exchange Place, Providence, R. I. . . Apr. 24, 1895.
Francis W. Dean . . . Mill Engineer and Architect . . . . . .
. . . . . 53 State St., Room 1110, Boston, Mass. . . . Apr, 17, 1908.
Hugh De Haven . . Prest. De Haven Mfg. Co. . . . . .
. . . . . 50 Columbia Heights, Brooklyn, N. Y. . . . Apr. 23, 1903.
John O. DeWolf, . . . Mech. Engineer, 159 Devonshire St., Boston, Mass. . . . Apr. 25, 1901.
Frederick N. Dillon . . D. M. Dillon Steam Boiler Works . Fitchburg, Mass. . . Sept. 22, 1904.
Ezra Dixon . . . . . Prest. and Treas. Dixon Lubricating Saddle Co. Bristol, R. I. Sept. 21, 1905.
Robert D. Douglas . . Cop Tube Manufacturer . . . . . .
. . . . . P. O. Box 704, 402 Bay St., Fall River, Mass. . . Sept. 21, 1905.
C. E. W. Dow . . . . Selling Agt. American Moistening Co. . . . . .
. . . . . P. O. Box 2189, 79 Milk St., Boston, Mass. . . . Apr. 24, 1895.

Charles E. Eager . . . Member Firm J. Russel Marble & Co. . . . . .
. . . . . 124 High St., Boston, Mass. . . . Apr. 27, 1905.
Fred W. Easton, . . . Treas. Easton & Burnham Machine Co., ...
. . . . . 180 Weeden St., Pawtucket, R. I. . . Apr. 25, 1901.
WilliamDresserEdwards, ... 3041 Deakin St., Berkeley, Cal. . . . Oct. 2, 1902.
G. B. Emmons . . . . Prest. Emmons Loom Harness Co. . . . . .
. . . . . 7 May St., Lawrence, Mass. . . Oct. 25, 1895.
George P. Erhard . . . Vice-Prest. & Treas. The Stafford Co. Readville, Mass. . . Apr. 27, 1905.
Edward J. Feeley . . . Mgr. Kale & Co., Inc., 88 Broad St., Boston, Mass. . . . . Oct. 4, 1907.

D. D. Felton . . . . . Treas. S. A. Felton & Son Co. . . . Manchester, N. H. . Apr. 24, 1895.
John W. Ferguson . . Engineer aud Bldg. Contractor . . . . . .
. . . . . United Bank Bldg., Paterson, N. J. . . . . Apr. 24, 1895.
E. C. Foerster . . . . Treas. American Textile Specialty Machinery Co. . . . .
. . . . . 363 Rider Ave., New York, N. Y. . . Sept. 22, 1904.

J. Herbert Foster . . . Cotton Broker . 10 South Water St., Providence, R. I. . . Apr. 24, 1895.
E. T. Fowler . . . . . Treas. and Mgr. Foster Machine Co., Westfield, Mass. . . Apr. 26, 1906.
John T. Fyans . . . . Agt. Fyans, Frazer & Blackway Co. . . . . .
. . . . . 411 Beach St., Fall River, Mass. . . Apr. 28, 1897.

H. P. Garland . . . . Treas. Garland Mfg. Co. . . . . Saco, Me. . . . . Oct. 25, 1895.
Royal W. Gates . . . . Josiah Gates & Sons . . . . . .
. . . . . 307 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Roland Gerry . . . . Asst. General Sales Agt. Jones & Laughlin Steel Co. . . .
. . . . . Pittsburg, Pa. . . . . Sept. 13, 1906.
Vladimir F. Gnesin . . Care, The Great Yaroslavl Mfg. Co. Moscow, Russia . . .
. . . . . Home address, 6 West 21st St., New York City . . . Oct. 1, 1903.
Rufus B. Goff . . . . Prest. Standard Mill Supply Co. . . . . .
. . . . . 77 Exchange Pl., P. O. Box 714, Providence, R. I. . . Apr. 28, 1897.
Arthur F. Gray . . . . Architect and Mill Engineer . . . . . .
. . . . . 53 State St., Room 509, Boston, Mass. . . . Oct. 18, 1900.
Joseph P. Gray . . . . Prest. Boston Mfrs. Mutual Fire Ins. Co. . . . . .
. . . . . 31 Milk St., Boston, Mass. . . . . Apr. 17, 1998.
Albert H. Green . . . Kitson Machine Shop . . . . . Lowell, Mass. . . . Apr. 17, 1908.
Samuel M. Green, . . . Consulting Engineer . . . . . Holyoke, Mass. . . . Apr. 24, 1902.
Harry S. Greene . . . Vice Prest. Woonsocket Napping Machinery Co. . . . .
. . . . . Woonsocket, R. I. . . Apr. 26, 1906.
Henry S. Greene, . . . Treas. Woonsocket Napping Machinery Co. . . . . .
. . . . . Woonsocket, R. I. . Apr. 26, 1906.
Russell Grinnell . . . Vice Prest. Gen. Fire Extinguisher Co. . . . . .
. . . . . Union Trust Bldg., P. O. Box 89, Providence, R. I. . . Apr. 26, 1906.
Edmond H. Guerin . . Mgr. American Paper Tube Co. . . Woonsocket, R. I. . . Apr. 25, 1907.
John Walter Gummey . George H. McFadden & Bro. . . . . .
. . . . . 70 Kilby St., Boston, Mass. . . . Apr. 17, 1908.

George B. Hamblin . . Purchasing Agt. Whitin Machine Works . . . . . .
. . . . . Whitinsville, Mass. . Apr. 25, 1907.
A. Walter Harris . . . Treas. A. W. Harris Oil Co. . . . . .
. . . . . P. O., Box 758, 326 So. Water St., Providence, R. I. . . Oct. 25, 1895.
Alfred H. Hartley . . Dealer in Oils and Mill Supplies . . . . . .
. . . . . P. O. Box 409, Fall River, Mass. . . Oct. 28, 1897.
Arthur A. Haserick . . Member of Firm Stoddard, Haserick, Richards & Co. . . .
. . . . . 152 Congress St., Boston, Mass. . . . . Sept. 13, 1906.
Edgar F. Hathaway . . Gen. Mgr., American Warp Drawing Machine Co. . . . .
. . . . . 289 A St., Boston, Mass. . . . Apr. 27, 1905.
William C. Hawes . . Director Taber Mill . . Pleasant St., New Bedford, Mass. . Sept. 13, 1906.
Jeffrey Hazard . . . . Prest. Hazard Cotton Co. . . . . Providence, R. I. . . Apr. 25, 1907.
Charles C. Hedrick . . Mech. Eng. Lowell Machine Shop . Lowell, Mass. . . . Apr. 23, 1903.
Richard H. Hill . . . Gen. Sales Agt. James Hunter Machine Co. . . . . .
. . . . . 70 Kilby St., Boston, Mass. . . . . Apr. 26, 1900.

Fred M. Hoadley . . . Sec'y and Treas. R. I. Contract Engineering Co. . . . . .
. . . . . 144 Westminister St., P. O. Box 1211, Providence, R. I. . . Apr. 17, 1908.
Charles E. Hodges . . Asst. Mgr. American Mutual Liability Co. . . . . .
. . . . . 50 State St., Boston, Mass. . . . . Apr. 17, 1908.
John Hogg . . . . . Smith, Hogg & Gardiner, 144 Essex St., Boston, Mass. . . . Apr. 27, 1899.
Henry S. Houghton, Sr., Mfr. Grids and Beaters, ...
. . . . . 74 Hamlet Ave., Woonsocket, R. I. . Apr. 28, 1897.
Lewis T. Houghton . . Prest. and Treas., . 89 Exchange St., Worcester, Mass. . . Sept. 26, 1901.
A. H. Howard . . . . Prest. and Treas. Howard Bros. Mfg. Co. . . . . .
. . . . . P. O. Box 54, Worcester, Mass. . . Sept. 26, 1901.
Frederic W. Howe . . Mgr. Providence Dept., Crompton & Knowles Loom Works
. . . . . 241 Harris Ave., P. O. Box 899, Providence, R. I. . . Apr. 24, 1902.
Samuel T. Hubbard . . Cotton Merchant, Hubbard Bros. & Co. . . . . .
. . . . . 66 Beaver St., New York, N.Y. . . . Sept. 13, 1906.
C. H. Hutchins . . . . Prest. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 25, 1895.

Daniel Jackson . . . . Cotton Buyer B. B. and R. Knight, . Providence, R. I. . . Apr. 24, 1902.
Albert A. Jenks . . . Prest. Fales & Jenks Machine Co. . Pawtucket, R. I. . . Sept. 21, 1905.

Lawrence M. Keeler . Whitin Machine Works . . . . . Whitinsville, Mass. . Sept. 26, 1901.
William B. Kehew . . The Kehew-Bradley Co., ...
. . . . . 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.
John E. Kendrick . . Prest. American Supply Co., P. O. Box 822 . . . . . .
. . . . . 11 Eddy St., Providence, R. I. . . Oct. 5, 1899.
Frank B. Kenney . . . Mgr. Care of T. C. Entwistle Co. . . . . .
. . . . . 297 Market St., Lowell, Mass. . . . Oct. 5, 1899.
Nathaniel Kinsman . . Choremi, Benachi & Co., 53 State St., Boston, Mass. . . . . Apr. 25, 1907.

W. C. Langford . . . Salesman, ... 14 Peck St., Providence, R. I. . . Apr. 27, 1899.
[illegible] Portland St. Boston, Mass. . . . . Apr. 25, 1907.

CORRECTION OF ADDRESS.

Stanley R. Latshaw . . Mgr. Textile Dept., Curtis Publishing Company . . . . . .
. . . . . 1 Madison Avenue, New York City . . . Apr. 17, 1908.

John H. Lawrence [illegible]
Frank A. LeValley . . Cotton Broker, Tuttle, Hurley & Co. . . . . .
. . . . . Fall River, Mass. . . Apr. 28, 1904.
Guy M. Lincoln . . . Sec'y The Bader Coal Co. . . . . .
. . . . . 131 State St., Room 515, Boston, Mass. . . . Apr. 17, 1908.
Arthur D. Little . . . Prest. and Mgr. Chemical Products Co. . . . . .
. . . . . 93 Broad St., Boston, Mass. . . . . Apr. 17, 1908.
John H. Lorimer . . . Builder of Textile Machines . . . . . .
. . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 28, 1897.

J. Herbert Foster . . . Cotton Broker . 10 South Water St., Providence, R. I. . . . Apr. 24, 1895.
E. T. Fowler . . . . . Treas. and Mgr. Foster Machine Co., Westfield, Mass. . . . Apr. 26, 1906.
John T. Fyans . . . Agt. Fyans, Frazer & Blackway Co. . . . . 411 Beach St., Fall River, Mass. . . . Apr. 28, 1897.

H. P. Garland . . . . Treas. Garland Mfg. Co. . . . . Saco, Me. . . . . Oct. 25, 1895.
Royal W. Gates . . . . Josiah Gates & Sons . . . . . 307 Market St., Lowell, Mass. . . . Apr. 24, 1895.
Roland Gerry . . . . Asst. General Sales Agt. Jones & Laughlin Steel Co. . . . . Pittsburg, Pa. . . . . Sept. 13, 1906.
Vladimir F. Gnesin . . Care, The Great Yaroslavl Mfg. Co. Moscow, Russia . . . . . Home address, 6 West 21st St., New York City . . . Oct. 1, 1903.
Rufus B. Goff . . . . Prest. Standard Mill Supply Co. . . . . 77 Exchange Pl., P. O. Box 714, Providence, R. I. . . . Apr. 28, 1897.
Arthur F. Gray . . . . Architect and Mill Engineer . . . . . 53 State St., Room 509, Boston, Mass. . . . Oct. 18, 1900.
Joseph P. Gray . . . . Prest. Boston Mfrs. Mutual Fire Ins. Co. . . . . 31 Milk St., Boston, Mass. . . . . Apr. 17, 1998.
Albert H. Green . . . Kitson Machine Shop . . . . . Lowell, Mass. . . . Apr. 17, 1908.
Samuel M. Green, . . . Consulting Engineer . . . . . Holyoke, Mass. . . . Apr. 24, 1902.
Harry S. Greene . . . Vice Prest. Woonsocket Napping Machinery Co. . . . . Woonsocket, R. I. . . . Apr. 26, 1906.
Henry S. Greene, . . . Treas. Woonsocket Napping Machinery Co. . . . . Woonsocket, R. I. . Apr. 26, 1906.
Russell Grinnell . . . Vice Prest. Gen. Fire Extinguisher Co. . . . . Union Trust Bldg., P. O. Box 89, Providence, R. I. . . . Apr. 26, 1906.
Edmond H. Guerin . . Mgr. American Paper Tube Co. . . Woonsocket, R. I. . . . Apr. 25, 1907.
John Walter Gummey . George H. McFadden & Bro. . . . . 70 Kilby St., Boston, Mass. . . . Apr. 17, 1908.

George B. Hamblin . . Purchasing Agt. Whitin Machine Works . . . . . 152 Congress St., Boston, Mass. . . . . Sept. 13, 1906.
Edgar F. Hathaway . . Gen. Mgr., American Warp Drawing Machine Co. . . . . 289 A St., Boston, Mass. . . . Apr. 27, 1905.
William C. Hawes . . Director Taber Mill . . Pleasant St., New Bedford, Mass. . Sept. 13, 1906.
Jeffrey Hazard . . . . Prest. Hazard Cotton Co. . . . . Providence, R. I. . . . Apr. 25, 1907.
Charles C. Hedrick . . Mech. Eng. Lowell Machine Shop . Lowell, Mass. . . . Apr. 23, 1903.
Richard H. Hill . . . Gen. Sales Agt. James Hunter Machine Co. . . . . 70 Kilby St., Boston, Mass. . . . . Apr. 26, 1900.

Fred M. Hoadley . . . Sec'y and Treas. R. I. Contract Engineering Co. . . . . .
. . . . . 144 Westminister St., P. O. Box 1211, Providence, R. I. . . Apr. 17, 1908.
Charles E. Hodges . . Asst. Mgr. American Mutual Liability Co. . . . . .
. . . . . 50 State St., Boston, Mass. . . . . Apr. 17, 1908.
John Hogg . . . . . Smith, Hogg & Gardiner, 144 Essex St., Boston, Mass. . . . Apr. 27, 1899.
Henry S. Houghton, Sr., Mfr. Grids and Beaters, ...
. . . . . 74 Hamlet Ave., Woonsocket, R. I. . Apr. 28, 1897.
Lewis T. Houghton . . Prest. and Treas., . 89 Exchange St., Worcester, Mass. . . Sept. 26, 1901.
A. H. Howard . . . . Prest. and Treas. Howard Bros. Mfg. Co. . . . . .
. . . . . P. O. Box 54, Worcester, Mass. . . Sept. 26, 1901.
Frederic W. Howe . . Mgr. Providence Dept., Crompton & Knowles Loom Works
. . . . . 241 Harris Ave., P. O. Box 899, Providence, R. I. . . Apr. 24, 1902.
Samuel T. Hubbard . . Cotton Merchant, Hubbard Bros. & Co. . . . . .
. . . . . 66 Beaver St., New York, N.Y. . . . Sept. 13, 1906.
C. H. Hutchins . . . . Prest. Crompton & Knowles Loom Works . . . . . .
. . . . . Worcester, Mass. . . Oct. 25, 1895.

Daniel Jackson . . . . Cotton Buyer B. B. and R. Knight, . Providence, R. I. . . Apr. 24, 1902.
Albert A. Jenks . . . Prest. Fales & Jenks Machine Co. . Pawtucket, R. I. . . Sept. 21, 1905.

Lawrence M. Keeler . Whitin Machine Works . . . . . Whitinsville, Mass. . Sept. 26, 1901.
William B. Kehew . . The Kehew-Bradley Co., ...
. . . . . 24 Purchase St., Boston, Mass. . . . Apr. 24, 1895.
John E. Kendrick . . Prest. American Supply Co., P. O. Box 822 . . . . . .
. . . . . 11 Eddy St., Providence, R. I. . . Oct. 5, 1899.
Frank B. Kenney . . . Mgr. Care of T. C. Entwistle Co. . . . . .
. . . . . 297 Market St., Lowell, Mass. . . . Oct. 5, 1899.
Nathaniel Kinsman . . Choremi, Benachi & Co., 53 State St., Boston, Mass. . . . . Apr. 25, 1907.

W. C. Langford . . . Salesman, ... 14 Peck St., Providence, R. I. . . Apr. 27, 1899.
Daniel G. Langlands . James S. Roberts Co., 137 Portland St., Boston, Mass. . . . . Apr. 25, 1907.
Charles D. Lanning . . Vice Prest. and Treas. American Warp Drawing Machine
. . . . . Company . . . . . 95 Milk St., Boston, Mass. . . . . Apr. 17, 1908.
Josiah M. Lasell . . . Whitin Machine Works, ... Whitinsville, Mass. . Apr. 24, 1895.
Stanley R. Latshaw . . Mgr. Textile Dept. Curtis Publishing Co. . . . . .
. . . . . 201 Madsion Ave., New York City . . . Apr. 17, 1908.
John H. Lawrence . . Top Roll Mfr. . . . . New Bedford, Mass. . Apr. 28, 1904.
Frank A. LeValley . . Cotton Broker, Tuttle, Hurley & Co. . . . . .
. . . . . Fall River, Mass. . . Apr. 28, 1904.
Guy M. Lincoln . . . Sec'y The Bader Coal Co. . . . . .
. . . . . 131 State St., Room 515, Boston, Mass. . . . Apr. 17, 1908.
Arthur D. Little . . . Prest. and Mgr. Chemical Products Co. . . . . .
. . . . . 93 Broad St., Boston, Mass. . . . . Apr. 17, 1908.
John H. Lorimer . . . Builder of Textile Machines . . . . . .
. . . . . Ontario and Lawrence Sts., Philadelphia, Pa. . . Oct. 28, 1897.

Stephen C. Lowe . . . Agt. John Hetherington & Sons, Ltd., ... 186 Devonshire St., Boston, Mass. . . . Oct. 25, 1895.
J. Irvine Lyle . . . . Gen. Mgr. Carrier Air Conditioning Co. . . . . Taylor Bldg., Cortlandt St., New York, N. Y. . . Apr. 17, 1908.

Rowland N. Mackay . Agt. The Stafford Co. . . . . Readville, Mass. . . Sept. 21, 1905.
R. M. Mackintosh . . . L. H. A. Schwartz, Importers of Cotton and Machinery . . . . . 141 Milk St., Boston, Mass. . . . . Oct. 4, 1907.
Augustus B. Marble . . Jones & Laughlin Steel Co., Board of Trade Bldg. . . . . 131 State St., Boston, Mass. . . . Apr. 25, 1907.
Edwin H. Marble . . . Vice-Prest. Curtis & Marble Machine Co. . . . . Cambridge St., Worcester, Mass. . . Sept. 13, 1906.
Edwin T. Marble . . . Prest. and Treas. Curtis & Marble Machine Co. . . . . Cambridge St., Worcester, Mass. . . Sept. 13, 1906.
Edward L. Martin . . Selling Agent, Howard & Bullough American Machine Co. . . . . Pawtucket, R. I. . . Apr. 25, 1907.
Fay H. Martin . . . . Prest. Textile Machinery Co. . . . . 60 India St., Boston, Mass. . . . . Sept. 26, 1901.
Henry W. Mason . . . Cotton Dealer, . 10 South Water St., Providence, R. I. . . Apr. 27, 1905.
F. H. Maynard . . . . Prest. & Mgr. Gen. Fire Extinguisher Co. . . . . Union Trust Bldg., Providence, R. I. . . Apr. 24, 1895.
John McCullough . . . Cotton Waste Merchant . . . . . New Bedford, Mass. . April 25, 1901.
J. Franklin McFadden . Member Firm George H. McFadden & Bro. . . . . 121 Chestnut St., Philadelphia, Pa. . . . Sept. 13, 1906.
H. G. McKerrow . . . Textile Machinery Importer . . . . . 141 Milk St., Boston, Mass. . . . Sept. 22, 1896.
D. K. McLaren . . . . Mfr. of Leather Belting 751 Craig St., Montreal, P. Q., Can. Apr. 26, 1900.
Meldon H. Merrill . . Eng. Westinghouse Elec. & Mfg. Co., ... 716 Board of Trade Bldg., 131 State St., Boston, Mass. . . . . Sept. 22, 1904.
Charles B. Moore . . . Mgr. Knowles Steam Pump Works . . . . . 42 Batterymarch St., Boston, Mass. . . . . Apr. 26, 1900.
Fred Moss . . . . . Holland & Webb, Commission Merchants . . . . . 495 Broome St., New York, N. Y. . . Sept. 21, 1905.
W. C. Murphy . . . . Union Hardware & Electric Supply Co. Providence, R. I. . . Apr. 25, 1907.

Hugh Nelson . . . . Mgr. Casualty Co. of America . . . . . 52 William St., New York, N. Y. . . Apr. 26, 1906.
John H. Nelson . . . . Treas. William Firth Co. . . . . 60 Baltimore St., Lynn, Mass. . . . . Apr. 26, 1900.
Charles H. Newman . . Webster Mfg. Co. . . 88 Reade St., New York, N. Y. . . Sept. 21, 1905.
William R. Noone, . . Jos. Noone's Sons Co. 102 South St., Boston, Mass. . . . Oct. 28, 1897.
Harry F. Nuzum . . . Cotton Broker, . . . 320 Broadway, New York City, N. Y. Apr. 17, 1908.

Thos. J. O'Keefe . . . American Belting and Tanning Co. . . . . 135 Oliver St., Boston, Mass. . . . . Apr. 28, 1904.

Sidney B. Paine . . . General Electric Co. . . 84 State St., Boston, Mass. . . . Apr. 24, 1895.
William F. Parish, Jr. . Chief of Tech. Dept. Vacuum Oil Co. . . . . .
. . . . . Briefe 1, Stubenring 2, Vienna, Austria . . . Apr. 24, 1902.
Frederic W. Parks . . . Mem. Firm G. M. Parks & Co. . . . . .
. . . . . 453 Main St., Fitchburg, Mass. . . Apr. 17, 1908.
Arthur Parkinson . . . Prest. Royal Chemical Co. . . . . Olneyville, R. I. . . Apr. 28, 1897.
John Parmenides . . . Choremi, Benachi & Co., 53 State St., Boston, Mass. . . . . Apr. 27, 1905.
John Perkins . . . . . Sales Agt. Hewes & Phillips Corliss Engines . . . . . .
. . . . . 735 Oliver Bldg., 141 Milk St., Boston, Mass. . . . Apr. 25, 1907.
Henry L. Phillips . . . Mgr. Factory Insurance Association . . . . . .
. . . . . 5 Haynes St., Hartford, Conn. . . . Oct. 4, 1907.
James C. Potter . . . . Prest. of Potter & Johnson Co. . . . Pawtucket, R. I. . . Sept. 21, 1905.
Charles A. M. Praray . Architect and Mill Engineer . . . . . .
. . . . . 48 Weybosset St., Providence, R. I. . . Apr. 28, 1897.
Charles F. Pray . . . . Cloth Broker . . . 66 Leonard St., New York, N. Y. . . Apr. 28, 1904.
James M. Prendergast . Broker in Cotton Cloths, 87 Milk St., Boston, Mass. . . . Apr. 26, 1906.
Theodore H. Price . . Cotton Dealer . . . 82 Beaver St., New York, N. Y. . . Oct. 2, 1902.

Frank W. Reynolds . . Mem. Firm Lockwood Greene & Co. . . . . .
. . . . . 93 Federal St., Boston, Mass. . . . Apr. 28, 1904.
Richard H. Rice . . . Engineer Turbine Dept. Gen. Elec. Co. West Lynn, Mass. . . Apr. 24, 1895.
Russell Robb . . . . . Stone & Webster . . . 147 Milk St., Boston, Mass. . . . Oct. 4, 1907.
E. R. Richardson . . . Asst. Treas. Howard & Bullough, American Machine Co., Ltd.
. . . . . P. O. Box 678, Pawtucket, R. I. . . Apr. 26, 1900.
C. E. Roberts . . . . Mgr. Hartford Steam Boiler Inspection & Insurance Co. .
. . . . . 101 Milk St., Room 400, Boston, Mass. . . . Apr. 24, 1895.
Charles Robbins . . . Eng. Westinghouse Electric & Mfg. Co., ...
. . . . . Pittsburg, Pa. . . . Apr. 25, 1907.
Elwin H. Rooney . . . The Whitin Machine Works . . . Whitinsville, Mass. . Apr. 26, 1906.
E. A. Rusden . . . . Gen. Mgr. Textile Finishing Machinery Co. . . . . .
. . . . . Howard Building, 83 Exchange Place, Providence, R. I. . . Sept. 21, 1905.

George W. St. Amant . Stephen M. Weld & Co., 89 State St., Boston, Mass. . . . Oct. 4, 1907.
J. L. Sanford . . . . . Asst. Sales Mgr. Barber-Colman Co. . . . . .
. . . . . 77 Washington St., North, Boston, Mass. . . . Apr. 27, 1905.
Dwight Seabury . . . Mill Engineer . . . 12 East Ave., Pawtucket, R. I. . . Apr. 25, 1901.
Harry A. Severson . . Secy & Gen. Mgr. Barber-Colman Co. Rockford, Ill. . . . . Oct. 4, 1907.
Frederick P. Shaw . . . . . Bristol, R. I. . . . Apr. 26, 1906.
Arthur N. Sheldon . . F. P. Sheldon & Co. Mill Engineers . . . . . .
. . . . . 49 Westminster St., Providence, R. I. . . Sept. 13, 1906.
Lewis T. Shurtleff . . . Agt. Paper Department, Pairpont Corporation, ...
. . . . . New Bedford, Mass. Apr. 28, 1904.
Abbott P. Smith . . . Director Soule, Butler and Kilburn Mills . . . . . .
. . . . . Seventh St., New Bedford, Mass. . . Sept. 13, 1906.
H. Cowles Smith . . . Mgr. Eastern Dist. Acme Steel Goods Co. . . . . .
. . . . . 28 Elm St., New York, N. Y. . . . Apr. 25, 1907.

Harry M. Smith . . . Vice Prest. Standard Mill Supply Co. . . . . .
. . . . . 39 Exchange Pl., Providence, R. I. . . Apr. 28, 1897.
R. Paul Snelling . . . Treas. Saco and Pettee Machine Shops . . . . . .
. . . . . Newton Upper Falls, Mass. . Sept. 22, 1896.
W. A. Spellissy . . . . Jenckes Spinning Co. . . . . Philadelphia, Pa. . . Sept. 21, 1905.
Henry C. Spence . . . Gen. Mgr. Metallic Drawing Roll Co. Indian Orchard, Mass. Apr. 24, 1895.
Wallace I. Stimpson . . . . . The Draper Co., 16 Church St., Milford, Mass. . . Sept. 21, 1905.
Jacob Stephans . . . . Gen. Mgr. William H. Haskell Mfg. Co. . . . . .
. . . . . Pawtucket, R. I. . . Apr. 26, 1906.
James Strang . . . . Selling Agt. Metallic Drawing Roll Co. . . . . .
. . . . . 123 Hampden St., Indian Orchard, Mass. Oct. 28, 1897.
Adolph Suck . . . . . Mill Architect & Engineer . . . . . .
. . . . . 179 Summer St., Boston, Mass. . . . Apr. 25, 1907.
Daniel J. Sully . . . . Cerro Colorado Mining Co. . . . . .
. . . . . 43 Exchange Place, New York, N. Y. . . Apr. 24, 1895.
E. Kent Swift . . . . Asst. Treas. Whitin Machine Works, Whitinsville, Mass. . . Apr. 27, 1905.
John Sykes, J. P. . . . Prest. English Card Clothing Co. . . . . .
. . . . . Acre House, Huddersfield, Eng. . Oct. 18, 1900.

Charles F. Taylor . . . Prop. Burgess Cop Tube Co., ...
. . . . . 15 Custom House St., Providence, R. I. . . Apr. 27, 1898.
Robert Taylor, Jr. . . . Managing Director Soho Iron Wks., Oldham, England . . Apr. 28, 1904.
George C. Tewksbury . Agt. American Ship Windlass Co. . . . . .
. . . . . 141 Milk St., Room 1102 Boston, Mass. . . . Apr. 24, 1902.
Gay D. Thayer . . . . . Crompton & Knowles Loom Works . . . . . .
. . . . . 667 Main St., Worcester, Mass. . . Apr. 25, 1907.
James T. Thornton . . Treas. Thornton Machinery Co. . . Providence, R. I. . . Oct. 18, 1900.
William V. Threlfall . . Gen. Mgr. Chapman Valve Mfg. Co., Indian Orchard, Mass., Apr. 24, 1895.
Rienzi W. Thurston . Mach. Mfr. . . . . Fall River, Mass. . . Oct. 18, 1900.
Newell W. Tilton . . . Harding, Whitman & Co. . . . . .
. . . . . 350 Broadway, New York, N. Y. . . . Apr. 17, 1908.
Allison W. Trafford . . Mfr. of Ring Travelers . . . . . .
. . . . . 221 Pocasset St., Fall River, Mass. . . Apr. 26, 1900.

Frank H. Underwood . Resident Mgr. Dodge Mfg. Co. . . . . .
. . . . . 137 Purchase St., Boston, Mass. . . . Apr. 29, 1896.

Clement A. Wakefield . Selling Agt. Saco & Pettee Machine Shops, ...
. . . . . 38 South St., Biddeford, Me. . . . Apr. 25, 1901.
Justin A. Ware . . . . . Spring Hill, Barnstable County, Mass. Oct. 25, 1895.
Lettice R. Washburn . Mill Contractor, 235 North Water St., New Bedford, Mass. . Oct. 5, 1899.
Walter S. Watson . . . Haworth & Watson, Mfrs. Paper Tubes for Textile Mfg. .
. . . . . P. O. Box 996, Lowell, Mass. . . . . Oct. 25, 1895.
Wright Webb . . . . Mgr. Boston Office, Providence Engineering Works . . .
. . . . . 131 State St., Room 503, Boston, Mass. . . . Apr. 17, 1908.

Stephen M. Weld	Stephen M. Weld & Co., 89 State St., Boston, Mass.		Apr. 27, 1899.
Alexander S. West	U. S. Gutta Percha Paint Co. . . . . 12 Dudley St., Providence, R. I.		Apr. 17, 1908.
W. W. White	Prest. Holyoke Machine Co.	Worcester, Mass.	Apr. 27, 1899.
John K. Whittier	Supt. Kitson Machine Shop	Lowell, Mass.	Sept. 21, 1905.
G. Marston Whitin	Treas. Whitin Machine Works	Whitinsville, Mass.	Apr. 24, 1895.
Fred A. Wilde	The Stafford Co., 11 Clifford St.	Readville, Mass.	Apr. 28, 1897.
Thomas Winn	P. O. Box 2072, New York, N. Y.		Apr. 25, 1907.

Honorary Members	4
Life Members	15
Active Members	769
Associate Members	205
Total Membership	993

MEMBERS OF THE ASSOCIATION,

May 1, 1908.

ARRANGED BY STATES.

MAINE.

Auburn	William Hayes	Barker Mill.
Augusta	Albert S. Pratt	Edwards Mfg. Co.
Augusta	John H. White	Edwards Mfg. Co.
Biddeford	Edmund E. Blake	Saco & Pettee Machine Shops.
Biddeford	Harry D. Lord	Saco & Pettee Machine Shops.
Biddeford	Robert McArthur	Pepperell Mfg. Co.
Biddeford	Clement A. Wakefield	Saco & Pettee Machine Shops.
Brunswick	Russell W. Eaton	Cabot Mfg. Co.
Kennebunk	Robert W. Lord	R. W. Lord & Co.
Lewiston	George W. Bean	Androscoggin Mills.
Lewiston	H. B. Estes	Continental Mills.
Lewiston	William D. Pennell	Hill Mfg. Co.
Lewiston	Herbert L. Pratt	
Portland	Lyman M. Cousens	Dana Warp Mills.
Richmond	George Fish	Knapp Spinning Mills.
Saco	H. P. Garland	Garland Mfg. Co.
Saco	James G. Garland	Garland Mfg. Co.
Saco	Elmer E. Page	York Mfg. Co.
Westbrook	Philip Dana	Dana Warp Mills.
Westbrook	Woodbury K. Dana	Dana Warp Mills.
West Kennebunk	W. K. Sanborn	R. W. Lord Co.

NEW HAMPSHIRE.

Dover	Charles H. Fish	Cocheco Mfg. Co.
Dover	Herbert W. Owen	Cocheco Mfg. Co.
Exeter	Chester D. Hatch	Exeter Mfg. Co.
Greenville	Frederick W. Ely	Columbian Mfg. Co.
Hooksett	Stephen N. Bourne	Dundee Mills.

Manchester	Henry Deane Bourne	Hooksett Mfg. Co.
Manchester	James E. Coburn	Stark Mills.
Manchester	D. D. Felton	S. A. Felton & Son Co.
Manchester	Elliott Cowdin Lambert	Amoskeag Mfg. Co.
Manchester	Charles H. Manning	Amoskeag Mfg. Co.
Manchester	Herman F. Straw	Amoskeag Mfg. Co. & Manchester Mills.
Manchester	William Parker Straw	Amoskeag Mfg. Co.
Milford	M. F. Foster	
Nashua	William F. Arthur	Nashua Mfg. Co.
Nashua	Harry H. Blunt	Wonolancet Co.
Nashua	William H. Cadwell	The Jackson Mfg. Co.
Nashua	Almon A. Milliken	The Jackson Mfg. Co.
Nashua	Roscoe S. Milliken	Nashua Mfg. Co.
Nashua	Walter Whipple	Nashua Mfg. Co.
Newmarket	Robert William Boys	Newmarket Mfg. Co.
Newmarket	William H. Garner	Newmarket Mfg. Co.
Penacook	F. E. Wattles	Boscawen Mills.
Peterboro	Albert W. Noone	Jos. Noone's Son's Co.
Pittsfield	William P. Adams	
Salmon Falls	J. Colby Lewis	Salmon Falls Mfg. Co.
Somersworth	Charles H. Plummer	Great Falls Mfg. Co.
Suncook	George F. Whitten	Suncook Mills.

VERMONT.

Burlington	Reuben A. Cooke	Queen City Cotton Co.
Burlington	Winthrop Parker	Queen City Cotton Co.
North Pownal	Thomas Armstrong	North Pownal Mfg. Co.

MASSACHUSETTS.

Adams	Joseph Brierley	W. C. Plunkett & Sons Warp Mill.
Adams	Z. D. Hall	Berkshire Cotton Mfg. Co.
Adams	Charles T. Plunkett	Berkshire Cotton Mfg. Co.
Adams	William B. Plunkett	Berkshire Cotton Mfg. Co., and Greylock Mills.
Adams	William C. Plunkett	W. C. Plunkett & Sons.
Adams	J. N. Sanderson	Renfrew Mfg. Co.
Adams	Charles R. Thomson	Renfrew Mfg. Co.
Amesbury	W. S. Hume	Hamilton Woolen Co.
Amesbury	Frederick J. Quinn	Hamilton Woolen Mills.
Andover	John W. Bell	Smith & Dove Mfg. Co.
Arlington Heights	Arthur Birch	Arlington Machine Works.
Blackstone	George E. Spofford	Blackstone Mfg. Co.

Bondsville	Elmer G. Childs	Boston Duck Co.
Bondsville	Samuel Stewart	Boston Duck Co.
Boston	Charles B. Amory	Hamilton Mfg. Co.
Boston	Frederic Amory	Nashua Mfg. Co., Jackson Mfg. Co.
Boston	Eugene C. Andres	Fr. Jac. Andres, Inc.
Boston	E. W. Atkinson	Stoddard, Haserick, Richards & Co.
Boston	Nathaniel F. Ayer	Farwell Bleachery.
Boston	Edwin Barnes	William Firth Co.
Boston	Colin C. Bell	American Vulcanized Fibre Co.
Boston	Albert Farwell Bemis	Jackson Fibre Co.
Boston	Frank P. Bennett	Am. Wool and Cotton Reporter.
Boston	Edward H. Best	Woolen Merchant.
Boston	F. H. Bishop	Universal Winding Co.
Boston	Arthur T. Bradlee	Harding, Whitman & Co.
Boston	Samuel N. Braman	Westinghouse Machine Co.
Boston	S. Parker Bremer	Monadnock Mills.
Boston	Henry Gordon Brinckerhoff	Green Fuel Economizer Co.
Boston	Harry S. Brown	New England Power Specialty Co.
Boston	John H. Burghardt	Page Belting Co.
Boston	Charles B. Burleigh	General Electric Co.
Boston	Hermon N. Burpee	Barber-Colman Co.
Boston	Arthur Cecil Butler	E. A. Leigh.
Boston	P. N. Caridia	Choremi, Benarchi & Co.
Boston	D. Allison Carrick	Sycamore Mills.
Boston	Augustus T. Clark	American Circular Loom Co.
Boston	Thomas J. Clexton	A. Klipstein & Co.
Boston	Frank B. Comins	American Moistening Co.
Boston	Daniel J. Danker	Danker & Marston.
Boston	Francis W. Dean	Mill Eng. & Architect.
Boston	Augustus De Cort	De Cort Yarn Co.
Boston	P. Y. DeNormandie	Bliss, Fabyan & Co.
Boston	John O. DeWolf	Mech. Engineer.
Boston	C. E. W. Dow	Am. Moistening Co.
Boston	Frederic C. Dumaine	Amoskeag Mfg. Co.
Boston	Charles E. Eager	J. Russel Marble & Co.
Boston	Edward J. Feeley	Kalle & Co. Inc.
Boston	William Firth	Am. Moist. Co. and Wm. Firth Co
Boston	Frederick A. Flather	Boott Mills.
Boston	Eugene N. Foss	Burgess Mills.
Boston	Alfred M. Goodale	Cloth and Yarn Broker.
Boston	Arthur F. Gray	Arc. & Mill Eng.
Boston	Joseph P. Gray	Boston Mfrs. Mutual Fire Ins. Co.
Boston	Edwin Farnham Greene	Pacific Mills, Lookwood, Green & Co.
Boston	S. Harold Greene	The Lawton Mills Corp.
Boston	John Walter Gummey	Geo. H. McFadden & Bro.
Boston	Arthur A. Haserick	Stoddard, Haserick, Richards & Co.
Boston	Edgar F. Hathaway	American Warp Drawing MachineCo.

Boston	Richard H. Hill	Jas. Hunter Machine Co.
Boston	William H. Hill	Renfrew Mfg. Co.
Boston	Franklin W. Hobbs	Arlington Mills.
Boston	Charles E. Hodges	American Mutual Liability Co.
Boston	John Hogg	Smith, Hogg & Gardiner.
Boston	Henry S. Howe	Lawrence & Co.
Boston	Charles W. Hubbard	Ludlow Mfg. Associates.
Boston	Otis L. Humphrey	Harding, Whitman & Co.
Boston	Joseph B. Jamieson	Holmes Knitting Co.
Boston	William B. Kehew	The Kehew-Bradley Co.
Boston	Nathaniel Kinsman	Choremi, Benachi & Co.
Boston	Daniel G. Langlands	James S. Roberts Co.
Boston	Charles D. Lanning	American Warp Drawing Machine Co.
Boston	Evan Arthur Leigh	232 Summer St.
Boston	Guy M. Lincoln	The Bader Coal Machine Co.
Boston	Arthur D. Little	Chemical Products Co.
Boston	Heury M. Lovering	Dwight Mfg. Co.
Boston	William C. Lovering	Whittenton Mfg. Co.
Boston	Stephen C. Lowe	John Hetherington & Sons, Ltd.
Boston	Herbert Lyman	26 Marlborough St.
Boston	Ronald T. Lyman	Boston Mfg. Co.
Boston	R. M. Mackintosh	L. H. A. Schwartz.
Boston	Charles T. Main	45 Milk St.
Boston	Augustus B. Marble	Jones & Laughlin Steel Co.
Boston	John P. Marston	Danker & Marston.
Boston	Fay H. Martin	Textile Machinery Co.
Boston	Fred C. McDuffie	York Mills, Everett Mills.
Boston	H. G. McKerrow	Tex. Mach. Importer.
Boston	Meldon H. Merrill	Westinghouse Elec. & Mfg. Co.
Boston	Charles B. Moore	Knowles Steam Pump Works.
Boston	George B. Morison	Ballou Yarn Co.
Boston	Robert W. Neff	Chemical Mfr.
Boston	Theodore O. Nicholson	Millen Mills.
Boston	William R. Noone	Joseph Noone's Sons Co.
Boston	Thomas J. O'Keefe	Am. Belting & Tanning Co.
Boston	Sidney B. Paine	General Electric Co.
Boston	John Parmenides	Choremi, Benachi & Co.
Boston	John Perkins	Hewes & Phillips Corliss Engines.
Boston	James M. Prendergast	Cat. Cloths & Yarns.
Boston	Frank W. Reynolds	Lockwood Greene & Co.
Boston	Charles E. Riley	C. E. Riley & Co.
Boston	Russell Robb	Stone & Webster.
Boston	C. E. Roberts	Hartford Steam Boiler Insp. & Ins.Co.
Boston	John H. Ross	R. W. Lord Co.
Boston	Arnold B. Sanford	Am. Cotton Yarn Exchange.
Boston	George W. St. Amant	Stephen M. Weld & Co.

Boston	J. L. Sanford	Barber-Colman Co.
Boston	J. Herbert Sawyer	147 Milk St.
Boston	George H. Shapley	Silver Lake Co.
Boston	Willis S. Shepard	American Net and Twine Co.
Boston	William F. Sherman	88 Broad St.
Boston	Adolph Suck	Mill Eng. and Architect.
Boston	John Sullivan	C. E. Riley & Co.
Boston	George C. Tewksbury	Amer. Ship Windlass Co.
Boston	James Thomson	Dwight Mfg. Co.
Boston	W. O. Todd	P. O. Box 31, Essex St. Station.
Boston	James P. Tolman	Samson Cordage Works.
Boston	Edward B. Townsend	Warwick Mills.
Boston	Frank H. Underwood	Dodge Mfg. Co.
Boston	Wright Webb	Prov. Engineering Works.
Boston	Stephen M. Weld	Stephen M. Weld & Co.
Boston	W. B. Smith Whaley	1012 Tremont Bldg.
Boston	William Whitman	Arlington Mills.
Boston	John H. Whitten	Wellington, Sears & Co.
Boston	Franklin D. Williams	Hamilton Mfg. Co.
Brockton	Horace A. Keith	Brockton Webbing Co.
Chelsea	Eugene Finocchiaro	17 Bloomingdale St..
Chicopee	Louis A. Aumann	Dwight Mfg. Co.
Chicopee	O. D. Drew	Dwight Mfg. Co.
Chicopee Falls	M. A. Rawlinson	Chicopee Mfg. Co.
Clinton	George W. Dunn	Lancaster Mills.
Clinton	William A. Fuller	Hudson Converting Co.
Clinton	Amos G. Hosmer	Lancaster Mills.
Clinton	Dexter Stevens	Lancaster Mills.
Clinton	Henry D. Martin	Lancaster Mills.
East Cambridge	Ivers S. Adams	American Net and Twine Co.
East Dedham	Benjamin M. Earl	Merchant Dye Works.
Easthampton	George A. Ayer	West Boylston Co.
Easthampton	G. Arthur Cook	West Boylston Mfg. Co.
Easthampton	John Skinner	West Boylston Mfg. Co.
East Douglas	Winfield S. Schuster	Forestdale Mills.
Fairhaven	Lewis E. Bentley	Taber Mill.
Fall River	F. S. Akin	Cornell Mills.
Fall River	Henry Ashworth	Ashworth Bros.
Fall River	J. W. Bailey	Bradford Durfee Textile School.
Fall River	V. T. Barber	Slater Cotton Mills.
Fall River	William M. Batt	The Davol Mills.
Fall River	John P. Bodge	Arkwright Mills.
Fall River	Charles N. Borden	Richard Borden Mfg. Co.
Fall River	Jefferson Borden, Jr.	Fall River Bleachery Co.
Fall River	Nathaniel B. Borden	Barnard Mfg. Co.
Fall River	Raymond D. Borden	Cotton and Cotton Yarns.
Fall River	James T. Broadbent	The Bradford Durfee Textile School.

Fall River	Isaac A. Brown	Narragansett Mills.
Fall River	Charles B. Chase	Lincoln Mfg. Co.
Fall River	Simeon B. Chase	
Fall River	John A. Collins	American Linen Co.
Fall River	Thomas D. Covel	The Covel and Osborne Co.
Fall River	Frederick E. Cunneen	Seaconnet Mills.
Fall River	Bradford D. Davol	Barnard Mfg. Co.
Fall River	George Delano	Bourne Mills.
Fall River	Robert D. Douglas	Cop Tube Mfr.
Fall River	David H. Dyer	D. H. Dyer & Son.
Fall River	John H. Estes	Cotton Manufacturer.
Fall River	William Evans	Hargraves and Parker Mills.
Fall River	Charles F. Farrar	49 Coggeshall St.
Fall River	John T. Fyans	Fyans, Frazer & Blackway Co.
Fall River	John F. Hamlet	P. O. Box 160.
Fall River	Alfred H. Hartley	Oils and Mill Supplies.
Fall River	William Hathaway	Barnard Mfg. Co.
Fall River	William B. Hawes	Yarn Broker.
Fall River	George H. Hills	Davol Mills and Stevens Mfg. Co
Fall River	John H. Holt	Luther Mfg Co.
Fall River	Herbert H. Horton	Troy Cotton & Woolen Manufactory.
Fall River	James B. Kerr	American Thread Co., Kerr Mills.
Fall River	Alexander King, Jr.	Amer. Thread Co.
Fall River	John Kniveton	The Bradford Durfee Textile School.
Fall River	Frank A. Le Valley	Tuttle, Hurley & Co.
Fall River	Leontine Lincoln	Seaconnet Mills.
Fall River	Charles B. Luther	Luther Mfg. Co.
Fall River	Alexander Makepeace	Richard Borden Mfg. Co.
Fall River	Arthur H. Mason	Davis Mills.
Fall River	Philip A. Mathewson	King Philip Mills.
Fall River	Thomas McAuliffe	Stevens Mfg. Co.
Fall River	James A. McLane	Davis Mills.
Fall River	Robert Place	Supt. Flint Mills.
Fall River	Joseph H. Potter, Jr.	Durfee Mills.
Fall River	George E. Prest	Bourne Mills.
Fall River	Charles H. Richardson Jr.,	Shove Mills.
Fall River	Harry J. Ricketson	Merchants' Mfg. Co.
Fall River	John Bion Richards	62 Barnaby St.
Fall River	Richard G. Riley	Davol Mills.
Fall River	Benj. H. Roberts	General Mill Supplies.
Fall River	Charles M. Shove	Granite Mills.
Fall River	W. Frank Shove	Pocassett Mfg. Co.
Fall River	Abbott E. Slade	Laurel Lake Mills.
Fall River	J. C. Smith	Chace Mills.
Fall River	Timothy Sullivan	Stafford Mills.
Fall River	James O. Thompson, Jr.	Wampanoag Mills.
Fall River	Rienzi W. Thurston	Machine Mfr.

Fall River	M. J. Toohey	Mfr. Rope, Twine and Banding.
Fall River	Allison W. Trafford	Mfr. Ring Travelers.
Fall River	Robinson Walmsley	Tecumseh Mills.
Fall River	Frederick E. Waterman	Stafford and Cornell Mills.
Fall River	Joseph Watters	Osborn Mills.
Fall River	Eben C. Willey	Barnaby Mfg. Co.
Fall River	Eugene F. Willey	Globe Yarn Mills.
Fall River	George W. Wright	Shove Mills.
Fisherville	Albert W. Dimick	Fisher Mfg. Co.
Fitchburg	Frederick N. Dillon	D. M. Dillon Steam Boiler Works.
Fitchburg	James C. Eteson	Orswell Mills.
Fitchburg	D. A. Everly	395 Water St.
Fitchburg	Ernest L. Hersom	Nockedge Mills.
Fitchburg	George P. Grant, Jr.	Grant Yarn Co.
Fitchburg	W. E. Keach	Grant Yarn Co.
Fitchburg	Arthur H. Lowe	Parkhill Mfg. Co.
Fitchburg	David Lowe	Parkhill Mfg. Co.
Fitchburg	Russell B. Lowe	Parkhill Mfg. Co.
Fitchburg	William F. Morgan	Fitchburg Duck Mills Co.
Fitchburg	Frederic W. Parks	G. M. Parks & Co.
Fitchburg	Thomas C. Sheldon	8 School St.
Fitchburg	Walter F. Stiles	Orswell Mills.
Fitchburg	Ralph E. Thomson	Parkhill Mfg. Co., Mill C.
Fitchburg	Arthur L. Willey	Grant Yarn Co.
Franklin	Harry T. Hayward	Forestdale Mfg. Co.
Franklin	Berry Laycock	Franklin Mills Corp.
Franklin	Joseph G. Ray	The Putnam Mfg. Co.
Great Barrington	Jno. H. C. Church	Monument Mills.
Griswoldville	Joseph W. Ballard	Griswoldville Mfg. Co.
Hebronville	Walter J. Howland	Hebron Mfg. Co., Hebron Mills.
Holyoke	Dickerson G. Baker	Samuel M. Green Co. Inc.
Holyoke	James A. Burke	Lyman Mills.
Holyoke	Charles W. Dennett	Hadley Mills.
Holyoke	Samuel M. Green	Consulting Engineer.
Holyoke	Willard W. Stearns	Farr Alpaca Co.
Hopedale	Eben S. Draper	Draper Co.
Hopedale	George A. Draper	Draper Co.
Hopedale	George Otis Draper	Northrup Loom Co.
Hopedale	Gen. William F. Draper	Textile Improvements.
Hopedale	Frank J. Dutcher	Draper Co.
Housatonic	Theodore Ellis Ramsdell	Monument Mills.
Hudson	J. C. Bolon	Hudson Converting Co.
Hyde Park	Calvin H. Lee	Readville Cotton Mills.
Indian Orchard	William C. Godfrey	Indian Orchard Co.
Indian Orchard	Henry C. Spence	Metallic Drawing Roll Co.
Indian Orchard	William M. Stevenson	Hodges Fibre Carpet Co.
Indian Orchard	James Strang	Metallic Drawing Roll Co.

Indian Orchard	William V. Threlfall	Chapman Valve Mfg. Co.
Ipswich	Henry Williams	Ipswich Mills.
Lawrence	James W. Ahmuty	Atlantic Cotton Mills.
Lawrence	Joshua D. Armitage	Marsdon St. Mill.
Lawrence	Joseph P. Battles	The Textile Mach'y Specialty Co.
Lawrence	J. B. Bolton	Arlington Mills.
Lawrence	Eugene E. Burnham	Belt Manufacturer.
Lawrence	G. B. Emmons	Emmons Loom Harness Co.
Lawrence	William D. Hartshorne	Arlington Mills.
Lawrence	Walter M. Hastings	Arlington Mills.
Lawrence	John T. Lord	Pacific Mills.
Lawrence	James I. Milliken	Everett Mills.
Lawrence	Walter E. Parker	Pacific Mills.
Lawrence	Robert Redford	P. O. Box 28.
Lawrence	Francis H. Silsbee	Pacific Mills.
Lawrence	Walter H. Summersby	Atlantic Cotton Mills.
Lawrence	William D. Twiss	Everett Mills.
Lawrence	William S. Whitney	American Woolen Co.
Linwood	Amos G. Maddox	Linwood Cotton Mill.
Lowell	George E. Ames	Lawrence Mfg. Co.
Lowell	Charles Ray Blake	Tremont and Suffolk Mills.
Lowell	Norman E. Borden	Lowell Weaving Co.
Lowell	Frank A. Bowen	Appleton Co.
Lowell	Edward N. Burke	216 Nesmith St.
Lowell	Paul Butler	Whittier Mills.
Lowell	W. W. Carey	Wood Rim Pulleys and Wood Working Machinery.
Lowell	Alfred M. Chadwick	Tremont and Suffolk Mills.
Lowell	Clarence N. Childs	Hamilton Mfg. Co.
Lowell	Avery B. Clark	Merrimack Mfg. Co.
Lowell	John J. Connell	Tremont and Suffolk Mills.
Lowell	A. G. Cumnock	Appleton Co.
Lowell	Joseph L. Cushing	Daniel Cushing & Co.
Lowell	John P. Davis	Pentucket Narrow Fabric Mills.
Lowell	Edward P. Dennis	50 Chelmsford St.
Lowell	Harry S. Duckworth	Print Works Hamilton Mfg. Co.
Lowell	John H. Dunn	Tremont & Suffolk Mills.
Lowell	Charles H. Eames	Lowell Textile School.
Lowell	Wm. Kendall Fairbanks	Bigelow Carpet Co.
Lowell	Vernon C. Faunce	Hamilton Mfg. Co.
Lowell	John W. Foster	Print Works, Hamilton Mfg. Co.
Lowell	Royal W. Gates	Josiah Gates & Sons.
Lowell	Albert H. Green	Kitson Machine Shop.
Lowell	Percy Gulline	Merrimack Print Works.
Lowell	William E. Hall	Shaw Stocking Co.
Lowell	Charles C. Hedrick	Lowell Machine Shop.
Lowell	Walter J. Holden	Boott Mills.

Lowell	Arthur W. Hunking	374 Stevens St.
Lowell	P. T. Jackson, Jr.	Lowell Weaving Co.
Lowell	Nelson D. Keables	Mass. Cotton Mills.
Lowell	Frank B. Kenney	T. C. Entwistle Co.
Lowell	Fred Lacey	Boott Mills.
Lowell	Charles F. Libby	Shaw Stocking Co.
Lowell	William A. Mitchell	Mass. Cotton Mills.
Lowell	Albert H. Morton	Lowell Machine Shop.
Lowell	Franklin Nourse	Lawrence Mfg. Co.
Lowell	Louis Atwell Olney	Lowell Textile School.
Lowell	John W. Pead	175 Fairmount St.
Lowell	Haven C. Perham	Kitson Machine Co.
Lowell	Thomas Perkins, Jr.	Tremont and Suffolk Mills.
Lowell	Victor E. Pihl	Boott Mills.
Lowell	Charles H. Richardson	156 Methuen St.
Lowell	John J. Rooney	Tremont & Suffolk Mills.
Lowell	Robert A. Smith	Mass. Cotton Mills.
Lowell	Stephen E. Smith	Lowell Textile School.
Lowell	William S. Southworth	Mass. Cotton Mills.
Lowell	John A. Stevens	Merrimack Mfg. Co.
Lowell	Earl A. Thissell	Lowell Hosiery Co.
Lowell	Ariel C. Thomas	Boott Cotton Mills.
Lowell	Arthur S. Thomas	Consolidated Cotton Duck Co.
Lowell	Fenwick Umpleby	Lowell Textile School.
Lowell	Charles T. Upton	63 Mt. Vernon St.
Lowell	Jude C. Wadleigh	Merrimack Mfg. Co.
Lowell	Walter S. Watson	Haworth & Watson.
Lowell	Channing Whitaker	Lowell Machine Shop.
Lowell	John K. Whittier	Kitson Machine Shop.
Lynn	John H. Nelson	Wm. Firth Co.
Lynn	Henry B. Sprague	Boston Woven Hose and Rubber Co.
Lynn	C. J. H. Woodbury	51 Baltimore St.
Manchaug	T. B. Stevenson	Manchaug Co.
Melrose	John E. Prest	9 Russell St.
Methuen	Lewis E. Barnes	
Methuen	John H. Binns	Arlington Mills.
Methuen	Charles E. Collins	Methuen Co.
Methuen	Alfred C. Gaunt	Tremont Worsted Co.
Methuen	Alfred Sagar	Arlington Mills, Cotton Dept.
Milford	Wallace I. Stimpson	The Draper Co.
Millbury	Fred W. Moore	Cordis Mills.
Millbury	Francis H. Rice	Holbrook Mfg. Co.
New Bedford	George H. Booth	Gosnold Mill.
New Bedford	Charles A. Bowen	S. C. Lowe Supply Co.
New Bedford	Christopher P. Brooks	
New Bedford	John L. Burton	Bristol Mfg. Corp.
New Bedford	Obadiah Butler	Faber Mills.

New Bedford	William A. Congdon	Whitman Mills.
New Bedford	Richard Cowell	81 Mt. Pleasant St.
New Bedford	William W. Crapo	Wamsutta Mills.
New Bedford	Mark B. Creed	Wamsutta Mills.
New Bedford	Andrew J. Currier	Nonquit Spinning Co.
New Bedford	Charles Owen Dexter	Beacon Mfg. Co.
New Bedford	John A. Fernley	Butler Mill.
New Bedford	Arnold C. Gardner	Manomet Mills.
New Bedford	William Edwin Hatch	New Bedford Textile School.
New Bedford	William C. Hawes	Taber Mill.
New Bedford	Hiram Higham	Wamsutta Mills.
New Bedford	Clark W. Holcomb	Old Colony Mills, Taunton.
New Bedford	Charles M. Holmes	Manomet Mills.
New Bedford	William H. Jenckes	Nonquitt Spinning Co.
New Bedford	Leonard Johnson	Page Mfg. Co.
New Bedford	Nathaniel B. Kerr	Butler Mill.
New Bedford	John W. Knowles	Page Mfg. Co.
New Bedford	Walter H. Langshaw	Dartmouth Mfg. Corp.
New Bedford	Leonard C. Lapham	Nonquitt Spinning Co.
New Bedford	John H. Lawrence	Top Roll Mfg.
New Bedford	Frederick B. Macy	Soule Mills.
New Bedford	John McCullough	Cotton Waste Merchant.
New Bedford	Robert P. McEwen	Mt. Pleasant Banding Corp.
New Bedford	Albert D. Milliken	New England Cotton Yarn Co.
New Bedford	John Neild	Grinnell Mfg. Corp.
New Bedford	H. W. Nichols	New Bedford Textile School.
New Bedford	Walter H Paige	Wamsutta Mills.
New Bedford	Albert R. Pierce	Pierce Mfg. Corp.
New Bedford	Andrew G. Pierce, Jr.	Pierce Mfg. Corp.
New Bedford	Frederick W. Reynolds	Potomska Mills.
New Bedford	Robert Schofield	New England Cotton Yarn Co.
New Bedford	Edwin G. Shepardson	Kilburn Mill.
New Bedford	Lewis T. Shurtleff	Pairpoint Corp.
New Bedford	Abbott P. Smith	Soule, Butler and Kilburn Mills.
New Bedford	Rufus A. Soule	Soule Mills.
New Bedford	Thomas Stone	141 Bonney St.
New Bedford	John B. Strongman	Gosnold Mills Co.
New Bedford	Frederic Taber	Taber Mill.
New Bedford	Samuel Taylor	Soule Mill.
New Bedford	Herbert E. Walmsley	Wamsutta Mills.
New Bedford	Lettice R. Washburn	Mill Contractor.
New Bedford	William R. West	Mt. Pleasant Banding Corp.
New Bedford	Benjamin Wilcox	City Mfg. Co.
New Bedford	George A. Wilson	Whitman Mills.
New Bedford	Samuel F. Winsper	New England Cotton Yarn Co.
Newburyport	Lewis Dexter, Jr.	Warner Cotton Mills.
Newburyport	John Gregson	Peabody Mfg. Co.

Newton	Josiah G. Coburn	99 Washington St.
Newton Upper Falls	Frank J. Hale	Saco and Pettee Machine Shops.
Newton Upper Falls	R. Paul Snelling	Saco and Pettee Machine Shops.
North Adams	William K. Greer	Eclipse & Beaver Mills.
North Adams	Hervey Burnham	Beaver Mills and Eclipse Mill.
North Adams	David A. Russell	Windsor Print Works.
North Andover	George W. Towne	62 Salem St.
Northampton	Charles E. Childs	West Boylston Mfg. Co. and Hampton Co
Northbridge	Earl S. Jenckes	Paul Whitin Mfg. Co.
Northbridge	Henry T. Whitin	Paul Whitin Mfg. Co.
Northbridge	Paul Whitin	Paul Whitin Mfg. Co.
North Brookfield	W. Marshall Taylor	Oxford Linen Mills.
North Oxford	Edwin N. Bartlett	Edwin Bartlett Co.
North Plymouth	Gideon F. Holmes	Plymouth Cordage Co.
North Uxbridge	Fred B. Whitin	Uxbridge Cotton Mills.
North Uxbridge	James Earl Whitin	Uxbridge Cotton Mills.
Pittsfield	Merton J. Wilmarth	J. L. & T. D. Peck Mfg. Co.
Readville	George P. Erhard	The Stafford Co.
Readville	Rowland N. Mackay	The Stafford Co.
Readville	Fred A. Wilde	The Stafford Co.
Rockland	George A. Woodward	Rockland Webbing Co.
Salem	Orin F. Bennett	Naumkeag Steam Cotton Co.
Salem	C. F. Curwen	Dinsmore Mfg. Co.
Salem	William P. McMullan	Naumkeag Steam Cotton Co.
Salem	Henry Osgood	P. O. Box 204.
Salem	Nathaniel G. Simonds	Naumkeag Steam Cotton Co.
Saundersville	Hiram L. Reynolds	Saunders Cotton Mills.
Shattuckville	Frank S. Field	Massaemit Yarn Mills.
Shirley	Newton Wilson	Samson Cordage Works.
Somerville	Albert Birch	Birch Bros. Co.
Somerville	George Crompton	Middlesex Bleachery.
South Boston	Robert Bishop	Robert Bishop Mfg. Co.
Southbridge	William A. Nichols	Hamilton Woolen Co.
Southbridge	Calvin D. Paige	Central Mills.
South Framingham	Bernard F. Merriam	Cordaville Woolen Co.
South Hadley Falls	Harlan Ingalls Dennett	Hadley Mills.
Spring Hill	Justin A. Ware	
Taunton	A. C. Bent	Safety Seamless Pocket Co.
Taunton	Peter H. Corr	Greenwich Bleachery.
Taunton	Thomas G. Cox	Mason Machine Works.
Taunton	H. H. Culver	Elizabeth Poole Mills.
Taunton	Henry S. Culver	Westville Cotton Mills.
Taunton	S. L. Gabriel	U. S. Linen Co.
Taunton	William M. Lovering	
Taunton	Charles L. Macomber	Winthrop Cotton Yarn Co.
Taunton	Herbert H. Shumway	Chestnut St.

Taunton	Elias S. Willis	New England Cotton Yarn Co.
Thorndike	Charles A. Tabor	Thorndike Co.
Three Rivers	Roscius C. Newell	Otis Co.
Three Rivers	Frederick A. Upham	Palmer Mill, Otis Co.
Turners Falls	Samuel L. Parker	Turners Falls Cotton Mills.
Waltham	Charles E. Getchell	Waltham Emery Wheel Co.
Waltham	Arthur H. Paul	Boston Mfg. Co.
Waltham	William G. McLoon	
Waltham	Paul C. Wilde	Middlesex Bleach, Dye & Print Works.
Ware	George E. Tucker	Otis Co.
Webster	Frank Hartley	S. Slater & Sons, Inc.
Webster	Frank Porter, Jr.	
Webster	William J. Stewart	S. Slater & Sons, Inc.
Westfield	E. T. Fowler	Foster Machine Co.
Westfield	W. H. Jillson	Mfr. Cotton Yarns.
West Lynn	Richard H. Rice	Gen. Elec. Co.
West Newton	Frederick T. Walsh	12 Valentine St.
West Warren	Walter B. Hall	West Warren Cotton Mills.
West Warren	William P. Holt	
Whitinsville	Alfred E. Adams	Whitinsville Cotton Mills and Linwood Mills.
Whitinsville	Melvin H. Coffin	Whitin Machine Works.
Whitinsville	James A. Cooper	Whitin Machine Works.
Whitinsville	George B. Hamblin	Whitin Machine Works.
Whitinsville	Lawrence M. Keeler	Whitin Machine Works.
Whitinsville	Josiah M. Lasell	Whitin Machine Works.
Whitinsville	E. Kent Swift	Whitin Machine Works.
Whitinsville	Oscar L. Owen	Whitin Machine Works.
Whitinsville	Elwin H. Rooney	Whitin Machine Works.
Whitinsville	Arthur F. Whitin	Saunders Cotton Mills.
Whitinsville	G. Marston Whitin	Whitin Machine Works.
Williamstown Sta.	Roland R. Kelly	Williamstown Mfg. Co.
Woburn	William W. Crosby	8 Court St.
Worcester	Henry Gage Baker	Stafford Co.
Worcester	George L. Brownell	Inventor and Builder of Improved Twisting Machinery.
Worcester	George Crompton	Crompton-Thayer Loom Co.
Worcester	Randolph Crompton	Crompton-Thayer Loom Co.
Worcester	Henry F. Harris	West Boylston Mfg. Co.
Worcester	Lewis T. Houghton	89 Exchange St.
Worcester	A. H. Howard	Howard Bros. Mfg. Co.
Worcester	C. H. Hutchins	Crompton & Knowles Loom Works.
Worcester	Edwin H. Marble	Curtis & Marble Machine Co.
Worcester	Edwin T. Marble	Curtis & Marble Machine Co.
Worcester	Geo. I. Rockwood	62 Summer St.
Worcester	Gay D. Thayer	Crompton & Knowles Loom Works.
Worcester	W. W. White	Holyoke Machine Co.

RHODE ISLAND.

Albion	Arnold B. Chace	Valley Falls Co.
Alton	Charles W. Shepard	Lace Mfr.
Allenton	R. A. Gray	Rodman Mfg. Co.
Anthony	Frank F. Woolley	Coventry Co.
Ashton	Charles H. Collins	Berkeley Co.
Ashton	Robert Stewart	Ashton Mills of Lonsdale Co.
Bristol	Ezra Dixon	Dixon Lubricating Saddle Co.
Bristol	Frederick P. Shaw	
Central Falls	Louis B. Barker	United States Cotton Co.
Central Falls	David Grove	United States Cotton Co.
Centreville	James T. Ferguson	Warwick Mills.
Crompton	Charles D. Robinson	Crompton Co.
East Greenwich	H. M. Peirce	Greenwich Bleachery.
Enfield	W. S. Trickett	Esmond Mills.
Fiskville	James Gee	Interlaken Dye Works.
Forestdale	William B. Orr	Forestdale Mfg. Co.
Forestdale	Alphonso F. White	Forestdale Mfg. Co.
Georgiaville	A. E. Bosworth	Bernon Mills.
Hamilton	Joseph Warren Greene	Hamilton Web Co.
Longmeadow	Abel T. Atherton	Machine Maker.
Lonsdale	Edward A. Mongeon	Lonsdale Mills.
Lonsdale	R. Irving Tobey	
Manville	A. Tenny White	Manville Co.
Natick	Andrew W. McAllister	
Natick	John G. McFadden	Natick Mills.
Olneyville	Arthur Parkinson	Royal Chemical Co.
Pawtucket	G. Bion Allen	J. & P. Coats, Ltd.
Pawtucket	Harold C. Barnefield	Hays Textile Co.
Pawtucket	Louis W. Bishop	Blackstone Webbing Co.
Pawtucket	William Washington Blades,	Lorraine Mfg. Co.
Pawtucket	E. R. Bullock	J. & P. Coats, Ltd.
Pawtucket	Robert Burgess	Burgess Mills.
Pawtucket	Alfred L. Clark	Greene & Daniels Mfg. Co.
Pawtucket	Amos Crankshaw	Lorraine Mfg. Co.
Pawtucket	John Crowther	Shannock Narrow Fabric Co.
Pawtucket	William P. Dempsey	Dempsey Bleachery & Dye Works.
Pawtucket	Henry C. Dexter	Greene & Daniels Mfg. Co.
Pawtucket	Robert Dow	Solway Dyeing & Textile Co.
Pawtucket	Fred W. Easton	Easton & Burnham Machine Co.
Pawtucket	Arthur H. Goff	D. Goff & Son.
Pawtucket	Lyman B. Goff	Union Wadding Co.
Pawtucket	William Halliwell	Solway Dye & Textile Co.
Pawtucket	Elisha H. Howard	Slater Cotton Co.
Pawtucket	Frederick L. Jenckes	Jenckes Spinning Co.
Pawtucket	J. E. Jenckes	The E. Jenckes Mfg. Co.

Pawtucket	Albert A. Jenks	Fales & Jenks Machine Co.
Pawtucket	John T. Kirk	Slater Cotton Co.
Pawtucket	William A. Lehan	Burgess Mills.
Pawtucket	James R. MacColl	Lorraine Manufg. Co.
Pawtucket	Edward L. Martin	Howard & Bullough Am. Machine Co.
Pawtucket	Frederick R. Mason	The Robert D. Mason Co.
Pawtucket	Edward J. McCaughey	Home Bleach & Dye Works.
Pawtucket	George A. Moody	206 Fountain St.
Pawtucket	O. B. Parker	180 Main St.
Pawtucket	James C. Potter	Potter & Johnson Co.
Pawtucket	Charles O. Read	Sayles' Bleacheries, and Glenlyon Dye Works.
Pawtucket	E. R. Richardson	Howard & Bullough, American Machine Co., Ltd.
Pawtucket	Israel P. Rounds	Naushon Co.
Pawtucket	Frank A. Sayles	Sayles' Bleacheries & Lorraine Mfg. Co.
Pawtucket	Dwight Seabury	Mill Engineer.
Pawtucket	W. H. Smith	American Textile Co.
Pawtucket	Jacob Stephans	William H. Haskell Mfg. Co.
Pawtucket	Edward Thayer	Lebanon Mill Co.
Pawtucket	S. Willard Thayer	Dexter Yarn Co.
Pawtucket	William P. Wood	The Jenckes Spinning Co.
Peace Dale	William C. Greene	Peace Dale Mfg. Co.
Phenix	Henry R. Brown	Phenix Mill.
Pontiac	Charles E. Thomas	
Providence	Charles T. Aldrich	Aldrich Manufg. Co.
Providence	John Ormsbee Ames	Fletcher Mfg. Co.
Providence	William Ames	Fletcher Mfg. Co.
Providence	George R. Babbitt	American Oil Co.
Providence	Edward R. Ballou	Ballou Yarn Co.
Providence	Edward R. Blanchard	Glenlyon Dye Works.
Providence	Joseph W. Booth	Atlantic Mills.
Providence	J. Frank Braids	Charles S. Bush Co.
Providence	H. Martin Brown	U. S. Bobbin & Shuttle Co.
Providence	E. C. Bucklin	Interlaken Mills.
Providence	Harris H. Bucklin	Interlaken Mills.
Providence	Frederic A. Chase	National Ring Traveler Co.
Providence	Charles H. Child	Standard Mill Supply Co.
Providence	Alfred M. Coats	J. & P. Coats, L't'd.
Providence	Frederick I. Dana	The Textile Finishing Machinery Co.
Providence	A. Lockwood Danielson	Quinebaug Co.
Providence	John W. Danielson	Lockwood Co., Ponemah Mills, Quinebaug Co., Wauregan Co., & Lewiston Bleachery & Dye Works.
Providence	Henry B. Deming	Deming Braiding Co.
Providence	Arthur W. Dennis	Elmwood Mills.

Providence	Albert J. Dronsfield	Fletcher Mfg. Co.
Providence	Jesse P. Eddy, Jr.	Tillinghast Stiles Co. and Fitch Mfg. Co.
Providence	F. C. Fletcher	Lawton Spinning Co.
Providence	J. Herbert Foster	Cotton Broker.
Providence	Arthur C. Freeman	Textile Finishing Machinery Co.
Providence	William Gammell	Berkeley Co.
Providence	R. H. I. Goddard, Jr.	Goddard Bros.
Providence	Rufus B. Goff	Standard Mill Supply Co.
Providence	Russell Grinnell	General Fire Extinguisher Co.
Providence	John H. Hambly	Quidnick Mfg. Co., and Windham Mfg. Co.
Providence	A. Walter Harris	A. W. Harris Oil Co.
Providence	Jeffrey Hazard	Hazard Cotton Co.
Providence	Fred M. Hoadley	R. I. Contract Engineering Co.
Providence	Alexander F. Hobbs	U. S. Finishing Co.
Providence	Frederic W. Howe	Crompton & Knowles Loom Works.
Providence	Albert C. Hoy	Grosvenor Dale Co.
Providence	Daniel Jackson	B. B. & R. Knight.
Providence	John E. Kendrick	American Supply Co.
Providence	W. C. Langford	14 Peck St.
Providence	Henry F. Lippitt	Manville Co.
Providence	Charles R. Makepeace	Mill Engineer.
Providence	Fred B. Manley	Atlantic Mills.
Providence	Henry W. Mason	Cotton Dealer.
Providence	F. H. Maynard	Gen. Fire Extinguisher Co.
Providence	Charles H. Merriman, Jr.	Manville Co.
Providence	W. C. Murphy	Union Hardware & Electric Supply Co.
Providence	William C. Peirce	Elizabeth Mills.
Providence	Charles A. M. Praray	Mill Engineer.
Providence	E. A. Rusden	Textile Finishing Machinery Co.
Providence	Robert Schaellibaum	Rob. Schaellibaum Co.
Providence	Arthur N. Sheldon	F. P. Sheldon & Co.
Providence	Frank P. Sheldon	Industrial Trust Building.
Providence	Harry M. Smith	Standard Mill Supply Co.
Providence	Antonio Spencer	Spencer Yarn Co.
Providence	Wilton H. Spencer	Textile Mfr.
Providence	Robert W. Taft	Coventry Co.
Providence	Charles F. Taylor	Burgess Cop Tube Co.
Providence	James T. Thornton	Thornton Machinery Co.
Providence	Robert B. Treat	Manufacturers' Fuel Co.
Providence	Fred Unger	48 Central St.
Providence	William P. Vaughan	The Putnam Mfg. Co.
Providence	Bertrand A. Webber	Nottingham Mill.
Providence	Alexander S. West	U. S. Gutta Percha Paint Co.
Quidnick	Alton L. R. Hambly	Quidnick Mfg. Co.
Riverpoint	Harry K. Drew	Valley Queen & Arctic Mills.

Saylesville	Charles F. Burnham	Crefeld Waste and Batting Co., and The L. A. Lockwood Co.
Saylesville	Stewart F. Carter	Glenlyon Dye Works.
Saylesville	L. A. Lockwood	Crefeld Waste and Batting Co., and The L. A. Lockwood Co.
Sayesville	John C. Whittaker	Glenlyon Dye Works.
Sayesville	Kenneth F. Wood	Sayles' Bleacheries.
Valley Falls	Benjamin C. Chace Jr.	Samoset Co.
Valley Falls	Malcolm G. Chace	Naushon Mfg. Co.
Valley Falls	Edward B. Jennings	Samoset Co.
Warren	Edward E. Bartlett	Parker Mills.
Warren	Arnold Schaer	Warren Mfg. Co.
Westerly	William Clark	Wm. Clark Mills, American Thread Co
Westerly	Robert B. Meikle	Lorraine Mfg. Co.
Westerly	Harry Tunstall	American Thread Co.
Woonsocket	L. W. Campbell	Woonsocket Machine & Press Co.
Woonsocket	Malcolm Campbell	Woonsocket Machine & Press Co.
Woonsocket	Harry S. Greene	Woonsocket Napping Machinery Co.
Woonsocket	Henry S. Greene	Woonsocket Napping Machinery Co.
Woonsocket	Edmond H. Guerin	American Paper Tube Co.
Woonsocket	William Halliwell	Providence and Woonsocket Mills of the Lawton Spinning Co.
Woonsocket	Edward W. Houghton	Globe Mill, Manville Co.
Woonsocket	Henry S. Houghton, Sr.	Mfr. Grids & Beaters.
Woonsocket	William N. Kimball	Social and Nourse Mills.
Woonsocket	Hadley D. Perkins	Bellingham Handkerchief Mfg. Co.
Woonsocket	Marcus J. Woodrow	Clinton Mfg. Co.

CONNECTICUT.

Baltic	Samuel T. Butterworth	Baltic Mills Co.
Baltic	William E. Peck	The Baltic Mills Co.
Danielson	W. Irving Bullard	E. H. Jacobs Mfg. Co.
Danielson	Gordon A. Johnstone	Danielson Cotton Co.
Danielson	James Herbert Smith	Quinebaug Co.
Grosvenor Dale	Charles H. Arnold	Grosvenor Dale Co.
Hartford	Henry L. Phillips	Factory Ins. Assn.
Jewett City	Frederick D. Ballou	W. A. Slater Mills.
Jewett City	James O. Sweet	Ashland Cotton Co.
Jewett City	Adelbert R. Young	Ashland Cotton Co.
Killingly	Clinton A. Atwood	Williamsville Mfg. Co.
Killingly	H. C. Atwood	Williamsville Mfg. Co.
Killingly	W. E. Atwood	Williamsville Mfg. Co.
Killingly	Ernest E. Clark	Williamsville Mfg. Co.
Killingly	Manley G. Morrill	Attawaugan Company.
Killingly	C. H. Truesdell	Attawaugan Co.

Middletown	Benjamin Forster	I. E. Palmer Mill.
Middletown	Frank B. Gustafson	I. E. Palmer Co., Cotton Spinning Mill.
Middletown	Joseph Merriam	Springfield Webbing Co.
Montville	W. G. Hartford	Monarch Woolen Mills.
Montville	Joseph Mercer	Mercer Mfg. Co.
Moosup	L. B. Cranska	Floyd Cranska Mills.
Mystic	A. E. Henry	
New Haven	George S. Barnum	The Bigelow Co.
Norwich	W. N. Blackstone	Attawaugan Co.
Norwich	W. R. Burnham	362 Main St.
Norwich	C. H. Frisbie	Attawaugan Co.
Norwich	W. G. Henderson	Falls Co.
Norwich	Wm. I. Woodward	Shetucket Co.
Plainfield	Harold Lawton	The Lawton Mills Corp.
Putnam	George W. Holt	Monohansett Mfg. Co.
Putnam	William Richardson	The Putnam Mfg. Co.
Putnam	George A. Vaughan	Putnam Mfg. Co.
Sterling	Harold Mowry	Br. U. S. Finishing Co.
Taftville	Joseph D. Aiken	Ponemah Mills.
Taftville	John Eccles	Ponemah Mills.
Versailles	Charles W. Perkins	The Totokett Mfg. Co.
Voluntown	George T. Briggs	The Briggs Mfg. Co.
Waterbury	Archer J. Smith	The American Mills Co.
Wauregan	James A. Atwood	Wauregan Co. & Quinebaug Co.
Wauregan	John Walter Atwood	Wauregan Co.
Willimantic	E. S. Boss	American Thread Co.
Willimantic	Peter Hardman	American Thread Co., Willimantic Mills.
Willimantic	James H. Ross	John L. Ross & Son.
Willimantic	Walter B. Knight	Windham Mfg. Co.
Windsor Locks	George M. Montgomery	The J. R. Montgomery Co.
Windsor Locks	J. R. Montgomery	The J. R. Montgomery Co.

NEW YORK.

Brooklyn	Hugh De Haven	De Haven Mfg. Co.
Capron	W. H. Cloher, Jr.	Utica Cotton Co.
Chadwicks	John McManus	The Utica Willowvale Bleachery Co.
Cohoes	David S. Johnston	Harmony Mills.
Cohoes	Henry C. Phillips	Harmony Mills.
Cohoes	James W. Taylor	Field & Hatch Knitting Co.
Elmira	William H. Bilbrough	Elmira Knitting Mills and Conewawah Spinning Co.
Jamestown	Henry Kay Smith	Jamestown Cotton Mill.
Jamestown	Thomas Henry Smith	Jamestown Cotton Mill.

New York City	Robert Franklin Adams	Adams Mfg. Co.
New York City	George Arms	Grand Hotel.
New York City	Edwin H. Baker	Bliss, Fabyan & Co.
New York City	Percy H. Brundage	49 Wall St.
New York City	Chas. F. Chase	Cling Surface Co. of Buffalo.
New York City	J. E. Cheesman	Cheesman Cotton Gin Co.
New York City	Chas. C. Cowan	Cotton Merchant.
New York City	Alfred L. Ferguson	Windsor Print Works.
New York City	E. C. Foerster	Amer. Textile Specialty Mach. Co.
New York City	Maylin Hamburger	2 Hudson St.
New York City	Charles M. Howard	Windsor Print Works.
New York City	Samuel T. Hubbard	Hubbard Bros. & Co.
New York City	Stanley R. Latshaw	Textile Department, Curtis Publishing Co.
New York City	J. Irvine Lyle	Carrier Air Conditioning Co.
New York City	Arthur B. Mann	J. H. Martin & Co.
New York City	John R. Mitchell	Mitchell-Bissell Co.
New York City	Fred Moss	Holland & Webb.
New York City	Hugh Nelson	Casualty Co. of America.
New York City	Charles H. Newman	Webster Mfg. Co.
New York City	Harry F. Nuzum	Cotton Broker.
New York City	Ramsay Peugnet	New York Silk Conditioning Works.
New York City	Chas. F. Pray	Cloth Broker.
New York City	Theodore H. Price	Cotton Dealer.
New York City	Henry S. Pritchett, LL. D.	576 Fifth Ave.
New York City	H. Cowles Smith	Acme Steel Goods Co.
New York Cily	Rufus A. Soule, Jr.	W. L. Heineman & Co.
New York City	Daniel J. Sully	Cerro Colorado Mining Co.
New York City	Newell W. Tilton	Harding, Whitman & Co.
New York City	Ridley Watts	Grinnell, Willis & Co.
New York City	Clarence Whitman	Wilkesbarre Lace Mfg. Co.
New York City	Harold C. Whitman	Esmond Mills.
New York City	Arthur Whittam	James E. Mitchell Co.
New York City	George A. Wies	Eureka Fire Hose Mfg. Co.
New York City	William E. Winchester	Deering, Milliken & Co.
New York City	Thomas Winn	P. O. Box 2072.
New York Mills, Oneida Co.,	John P. Campbell,	New York Mills.
New York Mills, Oneida Co.,	Robert G. McMeehan	
New York Mills, Oneida Co.,	Pardon B. Sanford	New York Mills.
Oswego	George E. Farrell	Ontario Knitting Co.
Oswego	James G. Merriman, Jr.	Standard Spinning Co.
Perry	Robert A. Copeland	Perry Knitting Co.
Perry	George M. Traber	The Perry Knitting Co.
Sloatsburg	Allan A. Freeman	Atlantic Fibre Co.
St. Johnsville	J. H. Reaney	Royal Gem Mills Co.
Utica	John W. Allis	Utica Knitting Co.
Utica	R. Bloss Billings	Utica Dyeing Co.

Utica	Thomas H. Conley	Mohawk Valley Cotton Mills.
Utica	John A. Crossland	Skenandoa Cotton Co.
Utica	George DeForest	Utica Steam and Mohawk Valley Cotton Mills.
Utica	James B. Duggan	41 Jewett Place.
Utica	Charles Hayes, Jr.	Skenandoa Cotton Co.
Utica	Henry F. Mansfield	Utica Steam Cotton Mills and Mohawk Valley Cotton Mills.
Utica	John E. McLaughlin	La Tosca Yarn Mill.
Utica	R. P. McLoughlin	La Tosca Yarn Mill.
Utica	Albion K. Searls	Oneita Knitting Mills.
Utica	John B. Wild	Oneita Knitting Mills.
Utica	Rex G. Witherbee	Utica Steam and Mohawk Valley Cotton Mills.
Victory Mills	J. Potter Harrington	Saratoga Victory Mills.

NEW JERSEY.

Atlantic City	Franklin P. Stoy	817 Pacific Ave.
Beverly	Alban Spooner	Beverly Underwear Co.
East Newark	Halsey Connett	Clark Mile End Spool Cotton Co.
East Newark	Adam H. Groel	Clark Mile End Spool Cotton Co.
East Newark	Alfred Lister	Clark Mile End Spool Co.
Gloucester City	George W. Grove	Argo Mills Co.
Gloucester City	Jesse A. Knight	Argo Mills Co.
Gloucester City	George W. Turner	
Jersey City	Ernest Bridge	Jas. Chadwick & Bro. Ltd.
Jersey City	Maxwell Grierson	Jas. Chadwick & Bro., Ltd.
Jersey City	B. L. Stowe	Eureka Fire Hose Mfg. Co.
Millville	John F. Reardon	Millville Mfg. Co.
Newark	James H. Abercrombie	Clark Thread Co.
Newark	William H. Loftus	Clark Thread Co.
New Brunswick	William Henry Hobbs	The Red Cross Cotton Mills.
Passaic	William L. Lyall	Brighton Mills.
Passaic	William H. Robinson	Brighton Mills.
Paterson	J. E. Barbour	Barbour Flax Spinning Co.
Paterson	John W. Ferguson	Eng. and Bldg. Contractor.
Trenton	Edward C. Stokes	Banker.

PENNSYLVANIA.

Chester	William S. Blakeley	Arasapha Co.
Chester	John W. France	The Aberfoyle Mfg. Co.
Chester	W. T. Galey	Aberfoyle Mfg. Co.

Chester	D. Edwin Irving	The Irving & Leiper Mfg. Co.
Chester	Robert F. Kineavy	Arasapha Mfg. Co.
Chester	John William Smith	T. I. Birken & Co.
Chester	D. Irving Trainer	Lincoln Mfg. Co.
Frankford, Phila.	Walter R. Garsed	Wingohocking Cotton Mills.
Frankford, Phila.	Otto Goetze	Glasgow Mills, Kensington Station.
Lancaster	George E. Zellers	John Farnum & Co.
Mt. Joy	Thomas J. Brown	George Brown's Sons.
Norristown	Arthur H. Gulliver	Wyoming Spinning Co.
Philadelphia	Bradley C. Algeo	Philadelphia Textile School.
Philadelphia	Robert Beatty	Robt. Beatty & Co.
Philadelphia	Robert C. Blood	John Blood & Co.
Philadelphia	T. Ashby Blythe	Ashby Cotton Mills.
Philadelphia	Edward Bromley	John Bromley & Sons.
Philadelphia	Joseph H. Bromley	Fourth and Lehigh Ave.
Philadelphia	Alfred H. Burnham	Glasgow Mills.
Philadelphia	Harry W. Butterworth	H. W. Butterworth & Sons.
Philadelphia	James Butterworth	H. W. Butterworth & Sons.
Philadelphia	E. G. Chester	Cedar and Huntingdon Sts.
Philadelphia	H. M. Daniel	The Mayo Mills and The Avalon Mills.
Philadelphia	Edward W. France	Philadelphia Textile School.
Philadelphia	Simon Friedberger	Friedberger Mfg. Co.
Philadelphia	Henry S. Grove	Argo Mills Co.
Philadelphia	James Henry	Thomas Henry & Sons.
Philadelphia	William G. Henry	Thomas Henry & Sons.
Philadelphia	Robert P. Hooper	Hooper Sons Mfg. Co.
Philadelphia	W. C. Houston	Hope Mills Mfg. Co.
Philadelphia	John H. Lorimer	Textile Machines.
Philadelphia	J. Franklin McFadden	George H. McFadden & Bro.
Philadelphia	David H. McKinley	Philadelphia Thread Co.
Philadelphia	Joseph B. Miller	Miller & Sons Co.
Philadelphia	Simon Miller	Jacob Miller Sons & Co.
Philadelphia	Theodore F. Miller	Stead & Miller Co.
Philadelphia	David Milne	C. J. Milne & Sons.
Philadelphia	Edward H. Sanborn	Cold Spring Bleach. & Fin. Works.
Philadelphia	Albert E. Schofield	Delph Spinning Co.
Philadelphia	W. A. Spellissy	Jenckes Spinning Co.
Philadelphia	William L. Turner	North American Lace Co.
Philadelphia	Joseph Wasserman	Philadelphia Tapestry Mills.
Philadelphia	William T. Westerman	Ontario Spinning Co.
Philadelphia	James S. Whitaker	William Whitaker & Sons.
Philadelphia	E. Wilkinson, Jr.	E. Wilkinson & Son.
Philadelphia	George Wood	Millville Mfg. Co.
Philadelphia	John P. Wood	William Wood & Co.
Philadelphia	Oscar W. Wood	Germantown Spinning Co.
Pittsburg	Roland Gerry	Jones & Laughlin Steel Co.
Pittsburg	Charles Robbins	Westinghouse Electric & Mfg. Co.

South Bethlehem	Frederick Ott	Lehigh Valley Silk Mills.
Yardley	Theodore C. Search	Cold Spring Bleaching and Finishing Works.

DELAWARE.

Wilmington	Daniel Moore Bates	Joseph Bancroft & Sons Co.
Wilmington	John B. Bird	Joseph Bancroft & Sons Co.

MARYLAND.

Baltimore	E. Stanley Gary	Gary Mfg. Co.
Baltimore	James A. Gary	Gary Mfg. Co.
Baltimore	Wm. E. Hooper	Woodberry Division of Mt. Vernon Woodberry Co.
Baltimore	Harry W. Kimball	Mt. Vernon Mills.
Baltimore	William G. Nichols	Consolidated Cotton Duck Co.
Baltimore	Charles K. Oliver	Consolidated Cotton Duck Co.
Baltimore	C. Singleton Green	Consolidated Cotton Duck Co.
Baltimore	Sewall K. Oliver	Consolidated Cotton Duck Co.
Baltimore	E. W. Thomas	Consolidated Cotton Duck Co.
Baltimore	Charles W. Wood	Consolidated Cotton Duck Co.

VIRGINIA.

Danville	George W. Robertson	Dan River Cotton Mills.

NORTH CAROLINA.

Asheville	Henry Rowe	Elk Mountain Bleachery.
Charlotte	E. N. Clemence	
Charlotte	Stuart W. Cramer	The Whitin Machine Works and Woonsocket Machine & Press Co.
Charlotte	Arthur J. Draper	Chadwick Hoskins Company.
Charlotte	Edward T. Garsed	
Charlotte	Arthur M. Hamilton	
Charlotte	R. M. Miller, Jr.	Elizabeth Mills.
Charlotte	Daniel A. Tompkins	D. A. Tompkins Co.
Charlotte	Frank S. Tucker	Westinghouse Elec. and Mfg. Co.
Duke	James R. Pearce	Erwin Cotton Mills.
Falls	Will Nelson	Neuse Mills.
Fayetteville	Frank H. Cotton	
Fayetteville	Walter L. Holt	Holt-Morgan Mills.
Fayetteville	Farquharson J. Muir	Holt-Morgan Mills.
Greensboro	Caesar Cone	Proximity Mfg. Co.

Lincolnton	R. S. Reinhardt	Elm Grove Cotton Mills.
Roanoke Rapids	Samuel F. Patterson	Roanoke Mills Co.
Spray	Aaron C. Phelps	German-American Co.
Winston-Salem	John W. Fries	F. & H. Fries. & Arista Mills Co

SOUTH CAROLINA.

Chester	Henry J. Forsyth	Springstein Mill.
Clemson College	Charles S. Doggett	Clemson College.
Columbia	Wallace L. Ball	Columbia Mills Co.
Columbia	D. W. Gray	Columbia Mills Co.
Columbia	Louis I. Guion	Columbia Mills Co.
Greenville	W. H. Rose	Olympia Cotton Mills.
Lancaster	Leroy Springs	Lancaster Cotton Mills.
Langley	Arthur T. Smith	Langley Mfg. Co. and Aiken Mfg. Co.
Newberry	Edward B. Wilbur	Mollohon Mfg. Co.
Rock Hill	Hamilton Carhartt	Hamilton Carhartt Cotton Mills.
Union	Henry Shaw Adams	Union Buffalo Mills Co.
Union	Hartley L. Lord	Union-Buffalo Mills Co.
Ware Shoals	W. C. Cobb	Ware Shoals Mfg. Co.

GEORGIA.

Aragon	Charles H. Gorton	Columbus Mfg. Co.
Atlanta	Oscar Elsas	Fulton Bag and Cotton Mills.
Atlanta	Henry E. Fisher	Atlanta Cotton Mills.
Atlanta	W. T. Jordan	
Augusta	Thomas Barrett, Jr.	Langley & Aiken Mills.
Augusta	T. I. Hickman	Graniteville Mfg. Co.
Augusta	Theodore S. Raworth	The Sibley Mfg. Co.
Augusta	Joel Smith	1311 Woodlawn Ave.
Augusta	George R. Stearns	Riverside Mills.
Chattahoochee	W. R. B. Whittier	Whittier Mills.
Columbus	Frederick B. Gordon	Columbus Mfg. Co.
Columbus	Walter Rigby	Bibb Mfg. Co.
Lindale	J. D. Mallory	Lindale Inn.
Lindale	Henry P. Meikleham	Mass. Mills in Georgia.
Macon	H. B. Hopson	Bibb Mfg. Co.
Macon	Logan Owen	Bibb Mfg. Co. Mill No. 1.
Macon	Broadus E. Willingham	Willingham Cotton Mills.
Monroe	Charles M. Sears	Monroe Cotton Mills.
Rome	R. L. Wilson	Floyd Cotton Mills.
Tennille	C. Enos Bean	Tennille Yarn Mills.

TENNESSEE.

Knoxville . . . . William T. Lang . . . . Brookside Mills.
Maryville . . . . . Albert Deabill . . . . . Maryville Hosiery Mills.

ILLINOIS.

Rockford . . . . . Howard D. Colman . . . Barber-Colman Co.
Rockford . . . . . Harry A. Severson . . . . Barber-Coleman Co.

LOUISIANA.

New Orleans . . . Henry C. Dresser . . . . McGinnis Cotton Mill.
New Orleans . . . . S. Odenheimer . . . . . Textile Mills Corp.

KENTUCKY.

Henderson . . . . Paul J. Marrs . . . . . Henderson Cotton Mills.
Louisville . . . . O. W. Stites . . . . . Louisville Cotton Mills Co.
Louisville . . . . Philip S. Tuley . . . . . Louisville Cotton Mills Co.

ALABAMA.

Cordova . . . . . Scott Maxwell . . . . . Indian Head Mills of Ala.
Mobile . . . . . Edward C. Beach . . . . Mobile Cotton Mills.
Pell City . . . . . T. H. Rennie . . . . . Pell City Mfg. Co.
Tallassee, Elmore County, Byron F. Card . . .
Tallassee . . . . . William E. Elsberry . . . Tallassee Falls Mfg. Co.
Tallassee . . . . . Arthur N. Hersom . . . . Tallassee Falls Mfg. Co.

CALIFORNIA.

Berkeley . . . . . William Dresser Edwards . 3041 Deakin St.
Redlands . . . . . Andrew W. McAllister . .

DISTRICT OF COLUMBIA.

Washington . . . . Berton A. Thissell . . . . 314 Ninth St., N. W.

CANADA.

Province of Ontario.

Cornwall	William V. Boyd	Canadian Col'd Cotton Mills Co. Ltd.
Cornwall	S. Greenwood	Canadian Col'd Cotton Mills Co. Ltd
Hamilton	George O. Dexter	Canadian Col'd Cotton Mills Co. Ltd.
Hamilton	Charles T. Grantham	Imperial Cotton Co.
Hamilton	James M. Young	Hamilton Cotton Co.
Paris	Richard Thomson	Penmans, Ltd.
Toronto	James P. Murray	Toronto Carpet Mfg. Co.

Province of Quebec.

Montmorency Falls	F. G. Daniels	Montmorency Br. Dominion Textile Co., Ltd.
Montreal	James H. Brand, Jr.	Cotton Broker.
Montreal	Arthur O. Dawson	Canadian Col'd Cotton Mills Co.
Montreal	James Dolphin	Mount Royal Spinning Co.
Montreal	C. B. Gordon	Dominion Textile Co., Ltd.
Montreal	D. K. McLaren	Leather Belting.
Montreal	A. B. Mole	Dominion Textile Co., Ltd.
Montreal	W. T. Whitehead	The Mount Royal Spinning Co., Ltd.
Valleyfield	Charles H. Potter	Montreal Cotton Co.
Valleyfield	Louis Simpson	Montreal Cotton Co.

NEW BRUNSWICK.

St. John	John B. Cudlip	Cornwall and York Cotton Mills Co.
St. John	S. P. Gerow	The Cornwall & York Cotton Mills.
Milltown	J. Whidden Graham	Canadian Col'd Cotton Mill Co., Ltd.
Milltown	W. H. Macdonald	Canadian Col'd Cotton Mill Co. Ltd.

ENGLAND.

Cheshire	William Myers	Lecturer in Textiles.
Eccles	Thomas William Fox	Municipal School of Technology Manchester.
Huddersfield	John Sykes	English Card Clothing Co.
Lees, North Oldham,	Hugh Walkinson Macalister,	Springhead Spinning Co., Ltd.
Manchester	J. R. Barlow	Barlow & Jones, Ltd.
Manchester	C. W. Macara	Henry Bannerman & Sons.
Manchester	John Lincoln Tattersall	Robert Hyde Buckley & Sons, Ltd.
Oldham	Robert Taylor, Jr.	Soho Iron Works.

FRANCE.

Rouen	Rene Nicolle	A. Avici et Cie Spinning Mill.

GERMANY.

Augsburg	Carl Clauss	Baumwollspinnerei am Stadtbach,
Plauen	Frederich Uebel	Gebruder Uebel Netzschkau u. Adorf.

PORTUGAL.

Lisboa	H. P. Taveira	236 Rua da Palma.

RUSSIA.

Moscow	Vladimir F. Gnesin	The Great Yaroslavl Mfg. Co.
Moscow	Vladimir Malinin	Prochoroff Three Hill Mfg. Co.

SPAIN.

Barcelona	Sr. D. Roman Macaya	Carribia 6.

AUSTRIA.

Bohemia	Robert Priebsch	Johann Priebsch Erben.
Vienna	Arthur Kuffler	Kuffler & Reichel.
Vienna	William F. Parish, Jr.	Vacuum Oil Co.

JAPAN.

Hiogo	Hachiro Henry Fukuhara	Sumoto Mill, Kanegafuchi Spinning Co.
Tokio	Narazo Takatsuji	The Kanegafuchi Cotton Spinning Co.

RECAPITULATION.

LOCATION OF MEMBERSHIP.

Maine	21
New Hampshire	27
Vermont	3
Massachusetts	476
Rhode Island	155
Connecticut	47
New York	67
New Jersey	20
Pennsylvania	52
Delaware	2
Maryland	10
Virginia	1
North Carolina	19
South Carolina	13
Georgia	20
Tennessee	2
Illinois	2
Mississippi	1
Louisiana	2
Kentucky	3
Alabama	6
California	2
District of Columbia	1
Province of Ontario	7
Province of Quebec	10
New Brunswick	4
England	8
France	1
Germany	2
Portugal	1
Russia	2
Spain	1
Austria	3
Japan	2
	993

IN MEMORIAM.

BRADFORD C. DIVINE.

BRADFORD C. DIVINE died at his home in Willowvale, N. Y., November 3, 1907, as the result of a long illness.

He was born in New York Mills, in 1844, and was in the service of the Utica Steam Cotton Mills for twenty-five years, then taking charge of the Utica-Willowvale Bleachery.

He was actively engaged in the affairs of the town, in which he was very highly respected. He was a member of the Masonic fraternity, and other organizations.

In 1867 he married Miss LUCY SAUNDERS of Utica, who survives him with three sons.

He became a member of this Association April 27, 1899.

FRANK H. DWELLY.

FRANK H. DWELLY, treasurer of the Tecumseh Mills, Fall River, Mass., died snddenly, January 25, 1908.

He was born in Augusta, Me., in 1855, and entered the office of the Tecumseh Mills after graduating from a business college in Providence, R. I. He was in the service of these mills for the whole of his life.

He became a member of this Association April 27, 1899.

HENRY S. HOUGHTON, JR.

HENRY S. HOUGHTON, JR., was a thorough mill man, having learned the mill business from his father. At the age of sixteen, he was overseer at the Smith's mill in Smithville, Barre, Mass. After a time, he left there to attend Wesleyan Academy, Wilbraham, Mass. With the exception of several years spent there he followed the mill business all his life, being overseer in Shirley Village, Blackstone, and at the Nourse Mill, Woonsocket.

In 1890 he left Woonsocket to accept a superintendent's position with the Paul Whitin Manufacturing Company, Northbridge, Mass., and was there until 1903, when he went to Montreal as general superintendent of the Merchants' Cotton Company. When a merger was formed uniting all the mills in Canada, Mr. HOUGHTON came back to the States, and at the time of his death, May 7, 1907, at the age of fifty-six, was superintendent at the Anchor Webbing Company, Woonsocket. Pneumonia followed by acute Brights' disease was the cause of death.

He left a widow, a son and a daughter.

He became a member of this Association April 24, 1895.

STEPHEN ALBERT KNIGHT.

STEPHEN ALBERT KNIGHT died at his home at Buttonwood, R. I., August 10, 1907.

He was one of the best types of American cotton manufacturers, having spent seventy-two years of life in cotton manufacturing. Beginning at the age of eleven years in the Harris Mills at Coventry, R. I., he worked up, step by step, and became overseer in the spinning room at Pontiac, until 1850. When the mill was closed he attended the Fruit Hill Academy.

In 1853, with his brothers, he formed the Hebron Manufacturing Company, with mills at Hebronville and Dodgeville,

Mass., and offices in Providence, R. I. He was also interested in other mill properties.

He was born at Cranston, R. I., June 5, 1828.

During his life he was a member of the Union Congregational Church of Providence, and several clubs. He became a member of this Association October 21, 1868, and was also a member of the Board of Directors, 1895–1898, and President, 1898–1899. He was a delegate at the first Conference of Cotton Growers and Manufacturers held at Washington, D. C., May, 1906, and took an active part in the proceedings.

He married ELLEN PARKER, May 5, 1851, by whom he is survived, and also by a daughter.

Mr. KNIGHT had a frank, forceful personality, which made his addresses before this Association objects of gratification and interest, the principal ones being, "Baling of Cotton," "Direct Selling of Cotton," "Goods for Bleacheries," "Government Cotton Crop Reports," "Handling and Transportation of Cotton," "Importance of Discussing Topical Questions," "Methods of Packing Goods for Bleacheries," "Prevention of Waste," "Relative Merits of Frame and Mule Yarns," "Reminiscences of Seventy-one Years in the Cotton Spinning Industry," "Re-Necking Rolls," "The Round Bale," "Starch in Slashers," "Tare on Cotton," "Use of Ring Frames as a Substitute for Twisters," "Valuation of Mill Property," and "Ventilation of Picker Rooms." His paper on "Reminiscences of Seventy-one Years in the Cotton Spinning Industry" was one of the most notable addresses ever given before this organization, attracting a great deal of attention both in America and abroad, not merely as recording the march of mechanical progress in manufacturing, but also the wonderful economic changes which have occurred to benefit the workers in the industry.

His addresses as President of the Association at the opening of each meeting were in like manner marked with a definite purpose.

As an instance of the maintenance of his youthful elasticity of mind, it may be noted that he took up the typewriter at the age

of seventy-eight, and composed not merely his correspondence, but also some more elaborate articles, such as the paper on his reminiscences, which was prepared without any preliminary notes.

ALVIN S. LYON.

ALVIN S. LYON, one of the most prominent members engaged in the worsted as well as the cotton manufactory, died at Swampscott, August 6, 1907, as the result of a short illness.

He was born in Methuen, Mass., March 1, 1839, his family being of English origin, the direct ancestors having settled in Connecticut in 1649.

He received his early education in Methuen and Lawrence, where he entered the employment of the Bay State Mills at the age of sixteen, becoming an expert operative in a large number of departments of different cotton and worsted mills. In 1867 he was in charge of the quilt room in the Beaman Mills, West Boylston, Mass. In 1873 he was superintendent of the Crescent Mills at Fall River, and afterwards took a similar position at the Durfee Mills in the same city. In 1883 he became superintendent of the Lowell Manufacturing Company, which later changed its name to the Bigelow Carpet Company. After a service of twenty-three years, he left this company to become agent for the Wood Worsted Mills of Lawrence, the largest establishment of its kind in the world.

He was survived by one son.

He became a member of this Association April 26, 1882.

WILLIAN C. TABER.

WILLIAM C. TABER died at New Bedford, December 23, 1907, where he was born in 1837.

He was educated at the Friends' School at Providence, and the Friends' College at Haverford, Penn. He was in several commercial enterprises which were successful, and in 1897 became treasurer of the Whitman Mills. He had been a member of the City Council, and was treasurer of the New Bedford Institution for Savings, a bank director, and also a prominent stockholder in many of the New Bedford corporations.

He became a member of this Association, September 21, 1905.

OLIVER H. MOULTON.

OLIVER H. MOULTON died at Lowell, September 22, 1907, at the age of seventy-seven years.

He was born at Dover, N. H., October 31, 1829. He was educated at the Saco, Me., Academy, and assisted in starting the Pepperell Mills at Biddeford, Me., was overseer at the Pemberton Mills in Lawrence for several years, and in 1864 was with the Amoskeag Mills at Manchester, N. H. He had been, for many years, agent of the Hamilton Manufacturing Company of Lowell, and was a director in other mechanical organizations. He was a member of the Congregational Church at Lowell, and one of the charter members of this Association, in which he took an intense interest, although never given to discussing matters from the floor.

FRANK P. VOGL.

FRANK P. VOGL died at Atlantic City, New Jersey, July 21, 1907. He was born at Cambridge, Mass., in 1854. He had been in the service of the Monadnock Mills of Claremont for many years, having succeeded to the agency in 1894. Failing health compelled him to resign from the mill a year before his

death, and also from the Claremont Gas Company, of which he was treasurer. He was a director in the Concord and Claremont Railroad, and for many years, a vestryman in the Trinity Episcopal Church.

Mr. VOGL contributed several addresses before this Association, on "Anchor Ice," "Card System in Mill Supply Accounts," "Economy of Using Turbines at Full Gate", "Effect of Humidity on Strength of Yarn," "Lug Straps for Broad Drop Box Looms," and "Regulation of Water Wheels," all of which were marked by his felicitous power of concentrated statement, by which he was able to give a practical paper of the utmost value in a very short space.

He became a member of this Association, September 27, 1894.

COLONEL SAMUEL WEBBER.

Colonel SAMUEL WEBBER died February 23, 1908, at Charlestown, N. H., where he was born, December 9, 1823.

His father was a physician, and his grandfather was a Doctor of Divinity, and President of Harvard College.

He was educated by his parents, and never attended any school. At eighteen he entered the employment of the Merrimac Manufacturing Company, Lowell, Mass., where he developed the etching process for engraving rolls. In 1847 he was draftsman and assistant engineer of the Bay State Mills, at Lawrence, Mass., where he was afterwards superintendent. In 1850 he was sent to Europe to study textile methods and machinery, and was one of the jurors at the Exposition in London, in 1851. In 1853 he held a similar position in the Crystal Palace Exhibition in New York. In 1854 he built the Indian Orchard Mills and operated it for four years. In 1858 he was manager of the Manchester Print Works, until 1864, when he

took charge of the Portsmouth Steam Mill, manufacturing spool cotton.

While at Indian Orchard, in connection with J. S. DAVIS, he formed and was Secretary of the Hampden County Cotton Spinners' Association in 1854, which was the first name of the New England Cotton Manufacturers' Association, which later became The National Association of Cotton Manufacturers.

During his life he did a large amount of experimental engineering work in water wheels and transmission of power by belting. He was one of the judges at the Centennial Exposition at Philadelphia in 1876, and at the Atlanta Exposition in 1882, and at the Exposition in New Orleans in 1884.

His engineering writings have been numerous, and he was also very proficient in several literary subjects. He was extremely fond of nature, both in hunting and fishing. As a very young man he accompanied Daniel Webster on some of his fishing trips in New Hampshire.

When he ceased to be manager of the mill he also dropped his membership in this Association, but in recognition of his work as a pioneer in American Cotton Manufacturing and also as the first secretary of the Association, he was elected an honorary member.

He is survived by a daughter and three sons.

TRANSACTIONS.

In accordance with legal notice the stated annual meeting of the Association, being the eighty-fourth meeting, was held at Huntington Hall, Massachusetts Institute of Technology, on Thursday and Friday, April 16 and 17, 1908.

The following 314 members and 127 guests were registered as being in attendance.

ALFRED E. ADAMS,
CHARLES B. AMORY,
EUGENE C. ANDRES,
THOMAS ARMSTRONG,
HENRY ASHWORTH,
H. C. ATWOOD,
GEORGE A. AYER,
NATHANIEL F. AYER,
E. G. BAILEY,
J. W. BAILEY,
HARRY G. BAKER,
EDWIN BARNES,
GEORGE S. BARNUM,
EDWIN N. BARTLETT,
JOSEPH P. BATTLES,
ROBERT BEATTY,
ALBERT FARWELL BEMIS,
JOHN H. BINNS,
F. H. BISHOP,
WILLIAM WASHINGTON BLADES,
CHARLES RAY BLAKE,
EDMUND E. BLAKE,
GEORGE H. BOOTH,
A. E. BOSWORTH,
STEPHEN N. BOURNE,
CHARLES A. BOWEN,
FRANK A. BOWEN,
WILLIAM V. BOYD,
ROBERT WILLIAM BOYS,
ARTHUR T. BRADLEE,
J. FRANK BRAIDS,
S. PARKER BREMER,
JAMES T. BROADBENT,
HARRY S. BROWN,
H. MARTIN BROWN,
HENRY R. BROWN,
GEORGE L. BROWNELL,
W. IRVING BULLARD,
E. R. BULLOCK,
ROBERT BURGESS,
JOHN H. BURGHARDT,
EDWARD N. BURKE,
CHARLES B. BURLEIGH,
HERVEY BURNHAM,
JOHN L. BURTON,
ARTHUR C. BUTLER,

HARRY W. BUTTERWORTH,
SAMUEL T. BUTTERWORTH,
WILLIAM H. CADWELL,
L. W. CAMPBELL,
W. W. CAREY,
P. N. CARIDIA,
D. ALLISON CARRICK,
STEWART F. CARTER,
BENJAMIN C. CHASE, Jr.,
ALFRED M. CHADWICK,
CHARLES F. CHASE,
FREDERIC A. CHASE,
ELMER G. CHILDS,
ERNEST E. CLARK,
JAMES E. COBURN,
JOSIAH G. COBURN,
MELVIN H. COFFIN,
CHARLES H. COLLINS,
JOHN J. CONNELL,
JAMES A. COOPER,
MARK B. CREED,
GEORGE CROMPTON,
WILLIAM W. CROSBY,
JOHN A. CROSSLAND,
ANDREW J. CURRIER,
JOSEPH L. CUSHING,
PHILIP DANA,
DANIEL J. DANKER,
ARTHUR O. DAWSON,
FREDERIC W. DEAN,
AUGUSTUS DECORT,
EDWARD P. DENNIS,
LEWIS DEXTER, Jr.,
FREDERICK N. DILLON,
EZRA DILLON,
C. E. W. DOW,
EBEN S. DRAPER,
GEORGE O. DRAPER,
HENRY C. DRESSER,
A. J. DRONSFIELD,
GEORGE W. DUNN,
JOHN H. DUNN,
FRANK J. DUTCHER,
CHARLES, E. EAGER
CHARLES H. EAMES,
FRED W. EASTON,
RUSSELL W. EATON,
FREDERICK W. ELY,
G. B. EMMONS,
GEORGE P. ERHARD,
JOHN H. ESTES,
JAMES C. ETESON,
JOHN A. FERNLEY,
FRANK S. FIELD,
WILLIAM FIRTH,
CHARLES H. FISH,
GEORGE FISH,
FREDERICK A. FLATHER,
M. F. FOSTER,
E. T. FOWLER,
EDWARD W. FRANCE,
JOHN W. FRANCE,
JOHN T. FYANS,
ARNOLD C. GARDNER,
H. P. GARLAND,
WILLIAM H. GARNER,
ROLAND GERRY,
CHARLES E. GETCHELL,
ALBERT H. GOFF,
ALFRED M. GOODALE,
GEORGE P. GRANT, JR.,
R. A. GRAY,
SAMUEL M. GREEN,
EDWIN F. GREENE,
S. HAROLD GREENE,
JOHN GREGSON,
DAVID GROVE,
EDMOND H. GUERIN,
FRANK J. HALE,
WALTER B. HALL,
WILLIAM HALLIWELL,
JOHN F. HAMLET,
GEORGE B. HAMLIN,
J. POTTER HARRINGTON,
HENRY F. HARRIS,
ALFRED H. HARTLEY,
FRANK HARTLEY,
WILLIAM D. HARTSHORNE,

Arthur A. Haserick,
Walter M. Hastings,
Chester D. Hatch,
Edgar F. Hathaway,
Charles Hayes, Jr.,
W. G. Henderson,
A. E. Henry,
Franklin W. Hobbs,
Clark W. Holcomb,
Walter J. Holden,
Charles M. Holmes,
George W. Holt,
John H. Holt,
Amos G. Hosmer,
Edward W. Houghton,
Henry S. Houghton, Sr.,
A. H. Howard,
Frederick W. Howe,
Walter J. Howland,
W. S. Hume,
Otis L. Humphrey,
Joseph B. Jamieson,
Earl S. Jenckes.
Leonard Johnson,
William B. Kehew,
Roland R. Kelly,
John E. Kendrick,
Frank B. Kenney,
Nathaniel Kinsman,
Jesse A. Knight,
Walter B. Knight,
Fred Lacey,
Elliot Cowdin Lambert,
W. C. Langford,
Leonard C. Lapham,
Stanley R. Latshaw,
Harold Lawton,
Berry Laycock,
Evan Arthur Leigh,
Charles F. Libby,
Henry F. Lippitt,
Arthur D. Little.
Harry D. Lord,
Stephen C. Lowe,
William L. Lyall,
Herbert Lyman,
James R. MacColl,
R. M. Mackintosh,
John MacManus,
Amos G. Maddox,
Charles T. Main,
Alexander Makepeace,
Charles R. Makepeace,
Fred B. Manley,
Henry F. Mansfield,
Augustus B. Marble,
Edwin H. Marble,
John P. Marston,
Edward L. Martin,
Henry D. Martin,
Robert McArthur,
Edward J. McCaughey,
H. G. McKerrow,
Robert G. McMeehan,
Robert B. Meikle,
Bernard F. Merriam,
Joseph Merriam,
Meldon H. Merrill,
Roscoe S. Milliken,
John R. Mitchell,
William A. Mitchell,
A. B. Mole,
Edward A. Mongeon,
J. R Montgomery,
George B. Morrison,
M. G. Morrill,
John Neild,
Robert W. Neff,
Hugh Nelson,
Theodore O. Nicholson,
William R. Noone,
Thomas J. O'Keefe,
William B. Orr,
Oscar L. Owen,
Sidney B. Paine,
Walter E. Parker,
Arthur H. Paul,
William E. Peck,

Haven C. Perham,
Thomas Perkins, Jr.,
Victor E. Pihl,
Robert Place,
Charles T. Plunkett,
Joseph H. Potter, Jr.,
George E. Prest,
John E. Prest,
F. J. Quinn,
Theodore E. Ramsdell,
Frank W. Reynolds,
Hiram L. Reynolds,
Francis H. Rice,
Richard H. Rice,
Charles H. Richardson,
E. R. Richardson,
Harry J. Ricketson,
Charles Robbins,
Benjamin H. Roberts,
Elwin H. Rooney,
Israel P. Rounds,
Alfred Sager,
George W. St. Amant,
W. K. Sanborn,
Arnold B. Sanford,
Pardon B. Sanford,
J. L. Sanford,
Dwight Seabury,
Albion K. Searls,
Thomas C. Sheldon,
Willis S. Shepard,
William F. Sherman,
Herbert H. Shumway,
Lewis T. Shurtleff,
Louis Simpson,
Abbott P. Smith,
Harry M. Smith,
J. C. Smith,
Robert A. Smith,
Stephen E. Smith,
Antonio Spencer,
George E. Spofford,
Dexter Stevens,
William M. Stevenson,
Robert Stewart,
William J. Stewart,
Walter F. Stiles,
Wallace I. Stimpson,
James Strang,
Walter H. Summersby,
James O. Sweet,
Charles A. Tabor,
James W. Taylor,
Samuel Taylor,
Gay D. Thayer,
Earl A. Thissell,
Ariel C. Thomas,
Arthur S. Thomas,
Edward W. Thomas,
Rienzi W. Thurston,
James P. Tolman,
George W. Towne,
W. S. Trickett,
C. H. Truesdell,
George E. Tucker,
George A. Vaughan,
Clement A. Wakefield,
Frederick T. Walsh,
Justin A. Ware,
Joseph Watters,
Alexander S. West,
Walter Whipple,
A. Tenney White,
Alphonso F. White,
W. W. White,
W. T. Whitehead,
William Whitman,
John G. Whittaker,
John H. Whitten,
John K. Whittier,
John B. Wild,
Fred A. Wilde,
Paul C. Wilde,
Eben C. Willey,
Henry Williams,
Elias S. Willis,
Oscar W. Wood,
William P. Wood,

C. J. H. WOODBURY, WILLIAM I. WOODWARD,
FRANK F. WOOLLEY.

GUESTS.

W. H. K. ABBOTT, Waterville, Me.
FRANCIS A. ADAMS, New York, N. Y.
E. H. ALDRICH, Taunton, Mass.
BARRETT ANDREWS, New York, N. Y.
W. G. ANTHONY, Providence, R. I.
H. D. ARNOLD, Killingly, Conn.
ROBERT C. ASHWORTH, Fall River, Mass.
A. S. ASPINWALL, Pawtucket, R. I.
F. S. BABCOCK, Lynn, Mass.
E. G. BAILEY, Boston, Mass.
HENRY J. BALLOU, Boston, Mass.
E. D. BANCROFT, Boston, Mass.
C. E. BLAIR, Boston, Mass.
F. BLAKE, Providence, R. I.
G. H. BLAKE, Boston, Mass.
W. S. BOLLOCH, New York, N. Y.
CHARLES J. BOYLE, Boston, Mass.
GUSTAV BRAUM, Boston, Mass.
W. M. BREWSTER, Exeter, N H.
G H. BRIDGE, Jr., Providence, R. I.
FRANK H. BURT, Boston, Mass.
A. L. BUZZELL, Woonsocket, R. I.
FRED CAMPBELL, Providence, R. I.
W. H. CARRIER, Buffalo, N. Y.
EDMUND CARRINGTON, New York, N. Y.
F. L. CHASE, Providence, R. I.
J. T. CHIDSEY, Bristol, Conn.
J. E. CLAIR, Chicago, Ill.
ALBERT CLARKE, Boston, Mass.
HENRY CLEWS, New York, N. Y.
ALEXANDER CORBITT, Boston, Mass.
WILLIAM P. COTHARIN, New York, N. Y.
W. J. CUTLER, Boston, Mass.
W. J. CURIT, Boston, Mass.
SAMUEL S. DALE, Boston, Mass.
M. A. DARY, Taunton, Mass.
B. W. DOW, Boston, Mass.
O. C. DUSSOSSOIT, Boston, Mass.
F. W. EAMES, Hartford, Conn.
W. J. EDDY, Worcester, Mass.

RICHARD E. EVANS, New Hartford, N. Y.
H. S. FAIRCLOUGH, Boston, Mass.
R. FISHER, Springfield, Mass.
S. W. FISKE, Providence, R. I.
W. W. FISKE, Providence, R. I.
E. C. FOSS, Lowell, Mass.
L. M. FOSS, Boston, Mass.
ELLIS FOSTER, Lawrence, Mass.
G. W. FOSTER, Lowell, Mass.
A. L. FOWLER, New York, N. Y.
F. A. FRANCIS, Providence, R. I.
A. F. FRASER, Fall River, Mass.
T. FRUSHER, New York, City.
C. P. GAUTIER, Boston, Mass.
FRANK GERNES, Fall River, Mass.
L. G. GOODRICH, Boston, Mass.
JOHN M. GRAHAM, Boston, Mass.
ALLIN GREENOUGH, Woonsocket, R. I.
JOSEPH GUILD, Jr., Boston, Mass.
E. D. HAGUE, Boston, Mass.
Rev. FREDERICK W. HAMILTON, Tufts College, Mass.
A. E. HAMMOND, New Bedford, Mass.
HAROLD C. HANSEN, New York, N. Y.
F. R. HARDENBURGH, Boston, Mass.
J. FRED HARVEY, Lowell, Mass.
N. HATCH, Albany, N. Y.
F. D. HEATH, Boston, Mass.
WILLIAM CARROLL HILL, Boston, Mass.
ROBERT J. HOGUET, New York, N. Y.
WILLIAM R. HORN, Philadelphia, Penn.
J. L. HORNOR, Helena, Ark.
GEORGE C. HOUGHTON, Boston, Mass.
F. HOWE, Providence, R. I.
E. M. JOHNSON, Providence, R. I.
MITCHELL JOHNSON, Methuen, Mass.
JAMES B. JONES, Boston, Mass.
E. S. KEEFER, New York, N. Y.
JOSEPH C. KING, Somerville, Mass.
S. W. KIRKLAND, Boston, Mass.
A. W. KIRKPATRICK, Boston, Mass.
G. M. KNOWLTON, Boston, Mass.
J. H. LANDT, Boston, Mass.
J. T. LEACH, Fall River, Mass.
HENRY G. LORD, Boston, Mass.

F. R. Low, New York, City,
Philip C. Lowe, Boston, Mass.
W. B. MacColl, Providence, R. I.
James A. MacDonald, Lawrence, Mass.
Peter B. MacManus, Chadwicks, N. Y.
Frank C. Marshall, Boston, Mass.
A. E. Mason, New Bedford, Mass.
R. E. McCausland, Boston, Mass.
W. H. McKibbin, Boston, Mass.
John S. Merchant, Providence, R. I.
Robert W. Merriam, Middletown, Conn.
E. L. Merrow, Providence, R. I.
M. A. Metcalf, Boston, Mass.
Herbert Midgeley, Worcester, Mass.
C. J. Morgan, New Hartford, N. Y.
Charles M. Mumford, Boston, Mass.
O. B. Munroe, Melrose, Mass.
Frank L. Nagle, Boston, Mass.
W. C. Nairn, Lawrence, Mass.
Arthur W. Newell, Providence, R. I.
L. S. Newell, Boston, Mass.
C. F. Newman, Boston, Mass.
E. Noble, Boston, Mass.
Arthur A. Noyes, Boston, Mass.
L. P. Nutting, New York, City.
F. W. O'Brien, Boston, Mass.
F. T. Page, Pawtucket, R. I.
Edward Palmer, Boston, Mass.
E. E. Palmer, Boston, Mass.
C. H. Parker, New York, City.
C. H. Parsons, Boston, Mass.
A. R. Patten, Fall River, Mass.
Bernard Peterson, Boston, Mass.
Charles W. Pierce, Charlotte, N. C.
Nathaniel Pope, Melrose, Mass.
Ralph S. Potter, Pawtucket, R. I.
Harvey N. Shepard, Boston, Mass.
William B. Weeden, Providence, R. I.
M. R. White, New York, City.
F. H. Williard, Worcester, Mass.
A. S. Winslow, Spartenburg, S. C.
Charles A. G. Winther, Boston, Mass.
James Wood, Boston, Mass.
George A. Yeo, Boston, Mass.

And others, as many guests as did not register.

FIRST SESSION.

THURSDAY MORNING, APRIL 16, 1908.

The Association met in Huntington Hall, Massachusetts Institute of Technology, Boston, Mass., at 11 A. M., the President, Mr. WILLIAM D. HARTSHORNE, in the chair.

The PRESIDENT. The hour has arrived, gentlemen, for which this meeting was called. If you will please come to order the Secretary will read the call.

The Secretary read the call for the meeting, as follows:

BOSTON, MASS, April 1, 1908.

To the Members:

Notice is hereby given that the stated Annual Meeting of this Association will be held at Boston, Mass., Thursday and Friday, April 16 and 17, 1908.

The sessions will be held in Huntington Hall of the Massachusetts Institute of Technology, 491 Boylston Street, Boston. The building can be reached by taking the elevated railway to the Park Street Station in the Subway, and changing there to any street car going south.

The sessions will be called to order on Thursday at 11 A. M., and 2 P. M.; on Friday at 10 A. M. and 2 P. M.

His Honor, EBEN S. DRAPER, Lieutenant-Governor, Acting-Governor, will welcome to the Commonwealth this Association, of which he is a member.

In addition to papers by members, addresses will be given during the sessions on invitation of the Board of Government, by ARTHUR A. NOYES, Ph.D., acting-President of the Massachusetts Institute of Technology; Hon. JAMES LOGAN, Mayor of Worcester, Mass.; WILLIAM B. WEEDEN, Providence, R. I.; WILLIAM HOWORTH, Esq., Bolton, England; E. G. BAILEY, Esq., Boston, Mass.; ROBERT J. HOGUET, Esq., New York; JOHN W. NASMITH, Esq., Manchester, England; and F. G. SCHELL, Esq., Lake Butler, Florida.

Thursday evening will be devoted to a Banquet at Hotel Brunswick at 6 o'clock for 6.30 P. M. The occasion will be entirely informal as to dress. Addresses are expected from a number of excellent speakers, among whom are His Honor GEORGE A. HIBBARD, Mayor of Boston; HENRY CLEWS, LL. D., N. Y.; Rev. FREDERICK W. HAMILTON, D. D., LL. D., President Tuft's College; Hon. HARVEY N. SHEPARD, Boston; WILLIAM WHITMAN, Esq., Boston, Mass. Music will be furnished by Keene's orchestra.

Members can obtain tickets for themselves and their guests at four dollars each before 10 o'clock on the day of the dinner by application to the Association, Post Office Box 3672, Boston, Mass.

The seats will be numbered and reservations will be made in the order of application, which can be made at any time to the Association.

As the Association does not keep an open account on the matter of the dinner, checks should accompany the orders for seats.

Candidates for membership can obtain tickets the same as members, but tickets for non-members must be obtained on their behalf by those members of whom they are personal guests.

The general arrangements will be in charge of NATHANIEL F. AYER, *Chairman;* ALBERT FARWELL BEMIS, ARTHUR T. BRADLEE, GEORGE B. MORISON, GEORGE W. ST. AMANT, JAMES P. TOLMAN.

The bills for dues for the fiscal year beginning April 1, 1908, are enclosed herewith.

By order of the Board of Government,

Respectfully submitted,

C. J. H. WOODBURY,
Secretary.

The full programme will not be issued until the meeting, but papers

are expected on the following subjects, and advance copies of any papers which are printed in time will be sent to members on request.

Arts of Weaving and Spinning.
Belts and Belt Transmission.
Combing Short Staple Cotton.
Conditioning Cotton Yarns.
Construction and Ventilation of a Weave Shed.
Cotton Cultivation in West Africa.
Cotton Mill Stocks as Investments.
Economic Possibilities of Good Lubrication.
Egyptian Cotton.
Heating Systems for Mills.
Improvements in the Cotton Fibre from the Storage of Seed Cotton.
Needs and Advantages of a Cotton Exchange in New England.
Sea Island Cotton.
Steam Turbines.
The Steadying Power and Influence of Consolidation.
What a Manufacturer Should Know about Coal.
Yarn Testing.

The Committee on Meeting, wearing white badges, consists of Messrs. ROBERT BEATTY, *Chairman;* JOSEPH P. BATTLES, JOHN H. C. CHURCH, THOMAS G. COX, PHILIP DANA, DANIEL J. DANKER, JOHN A. FERNLEY, FRANK J. HALE, FREDERIC W. HOWE, JOSEPH B. JAMIESON, PARDON B. SANFORD, and G. MARSTON WHITIN, will have general charge of the sessions.

Hotel Brunswick, opposite the Institute of Technology, will serve a special lunch on Thursday and Friday in a dining room reserved from 12.30 until 2.30 for those attending the meetings. Tickets to be obtained at the hotel desk.

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment, but other souvenir badges will be given to the guests of members.

Many desirable persons have not become members because they have not been invited. Candidates for membership will receive the

same privileges as members. Blank propositions are inside the front cover of the Transactions, or will be sent on application.

The Boston Museum of Fine Arts invites the members to examine their collection of Textiles at any time between 9 A. M., and 1 P. M., or between 2 P. M. and 5 P. M., on either day of the meeting. In addition to the tapestries, rugs, velvets and silks exhibited in the Textile Gallery on the second floor, a large collection of rare textiles may be seen in Room 14 in the basement of the building. Members will be admitted free on exhibition of badge, and others will pay the usual entrance fee of twenty-five cents.

A limited number of signed tickets, each admitting the bearer with friends, including ladies, to the seventy-eighth exhibition of paintings at the Boston Art Club, corner of Dartmouth and Newbury streets, open from 9 A. M., to 10 P. M., may be obtained of the Secretary.

Copies of the Report of the Fourth International Cotton Congress held at Vienna, will be sent free on application, to this Association, Postoffice Box 3672, Boston, Mass., or can be obtained at the meeting.

Members who have overlooked their postal card receipts for Transactions are requested to give the matter attention, as it is only through this means that the headquarters of the Association are able to know that members receive the volumes and notices to which they are entitled, and to keep an accurate record for sending Transactions and notices to members.

It is important that the Association should be promptly imformed of changes of address of any members, in order that they may receive their copies of Transactions.

The SECRETARY. Mr. President, I certify that a copy of the call was mailed to each member at least ten days before this date, in accordance with Article 16 of the by-laws, and that a quorum is now present for the transaction of any business which may come before this meeting.

The program of the meeting was as follows:

PROGRAMME.

First Session, Thursday, April 16, 1908, at 11 A. M.

Call to Order.

Business.

Report of Secretary.

Report of Treasurer.

Report of Auditor.

Award of Association Medal.
CHARLES B. BURLEIGH, *Chairman*, Boston, Mass.

Welcome to the Institute.
ARTHUR A. NOYES, Ph. D., President Massachusetts Institute of Technology, Boston, Mass.

Welcome to the Commonwealth of Massachusetts.
His Honor, EBEN S. DRAPER, Lieutenant-Governor, *Acting Governor.*

President's Address.
WILLIAM D. HARTSHORNE, Lawrence, Mass.

The Steadying Power and Influence of Consolidation.
Hon. JAMES LOGAN, Mayor, Worcester, Mass.

The Arts of Weaving and Spinning.
WILLIAM B. WEEDEN, Providence, R. I.

Cotton Mill Stocks as Investments.
W. IRVING BULLARD, Danielson, Conn.

Propositions for membership should be in the hands of the Secretary on Thursday

Hotel Brunswick opposite the Institute of Technology will serve a special lunch on Thursday and Friday, in a dining room reserved,

from 12.30 until 2.30 for those attending the meetings. Tickets to be obtained at the hotel desk.

Second Session, Thursday, April 16, 1908, at 2 P. M.

Business.

The Need and Advantages of a Cotton Exchange in New England.
JAMES R. MACCOLL, Pawtucket, R. I.

Improvements in the Cotton Fibre from Storage of Seed Cotton.
The Department of Agriculture, Washington,D. C.

Egyptian Cotton.
P. N. CARIDIA, Boston, Mass.

Sea Island Cotton.
F. G. SCHELL, Secretary Sea Island Cotton Association
Lake Butler, Florida.

THE ASSOCIATION DINNER.

Thursday evening will be devoted to a banquet in Hotel Brunswick at 6 o'clock, for 6.30 P. M. The occasion will be entirely informal as to dress. Addresses are expected from a number of excellent speakers, among whom are His Honor GEORGE A. HIBBARD, Mayor of Boston; HENRY CLEWS, LL. D., New York; Rev. FREDERICK W. HAMILTON, D.D., LL. D., President Tufts College; Hon. HARVEY N. SHEPARD, Boston; WILLIAM WHITMAN, Esq., President National Association of Woolen Manufacturers, Boston, Mass. Music will be furnished by Keene's orchestra.

The general arrangements will be in charge of the dinner committee, consisting of Messrs. NATHANIEL F. AYER, *Chairman;* ALBERT FARWELL BEMIS. ARTHUR T. BRADLEE, GEORGE B. MORISON, GEORGE W. ST. AMANT, and JAMES P. TOLMAN.

Members can obtain tickets for themselves and their guests at four dollars each before noon on Thursday, by application at the office of the Association or of the Dinner Committee at the meeting.

Candidates for membership can obtain tickets the same as members, but tickets for non-members must be obtained on their behalf by those members of whom they are personal guests.

Third Session, Friday, April 17,, 1908, at 10 A M.

Cotton Cultivation in West Africa.
WILLIAM HOWARTH, Bolton, England.

Conditioning Cotton Yarns.
ROBERT J. HOGUET, 138 Spring St., New York City.

Yarn Testing.
WILLIAM MYERS, Manchester, England.

Combing Short Staple Cotton.
JOHN W. NASMITH, Manchester, England.
(To be read by STEPHEN C. LOWE.)

Economic Possibilities of Good Lubrication.
WILLIAM F. PARISH, Jr., Briefe 1, Stubenring 2, Vienna, Austria. (To be read by C. H. PARKER of New York City.)

Fourth Session, Friday, April 17, 1908, at 2 P. M.

The Construction and Ventilation of a Weave Shed.
SAMUEL M. GREEN, C. E., Holyoke, Mass.

Election of Members.

Belts and Belt Transmission.
CHAS. F. CHASE, 39 Cortlandt St., New York City.

Steam Turbines.
MELDON H. MERRILL, Boston, Mass.

Election of Officers.

What a Manufacturer Should Know About Coal.
E. G. BAILEY, Chief of Coal Department, Arthur D. Little Laboratory, Boston, Mass.

Heating Systems for Mills.
A. G. HOSMER, M. E., Clinton, Mass.

The committee on meeting, wearing white badges, consists of Messrs. ROBERT BEATTY, *Chairman;* JOSEPH P. BATTLES, JOHN H. C. CHURCH, THOMAS G. COX, PHILIP DANA, DANIEL J. DANKER, JOHN A. FERNLEY, FRANK J. HALE, FREDERIC W. HOWE, JOSEPH B. JAMIESON, PARDON B. SANFORD and G. MARSTON WHITIN, who will have general charge of the sessions.

The souvenir badges will be given to those members who are in attendance, and the Board of Government has given instructions that duplicates shall not be given until after the adjournment, but other souvenir badges will be given to the guests of members.

The Boston Museum of Fine Arts invites the members to examine their collection of Textiles at any time between 9 A. M. and 1 P. M., or between 2 P. M. and 5 P. M., on either day of the meeting. In addition to the tapestries, rugs, velvets and silks exhibited in the Textile Gallery on the second floor, a large collection of rare textiles may be seen in room 14 in the basement of the building.

Members will be admitted free on exhibition of badge and others will pay the usual entrance fee of twenty-five cents.

A limited number of signed tickets, each admitting the bearer with friends, including ladies, to the seventy-eighth exhibition of paintings at the Boston Art Club, corner of Dartmouth and Newbury streets, open from 9 A. M. to 10 P. M., may be obtained from the Secretary.

Copies of the Report of the Fourth International Cotton Congress of Master Cotton Spinners' and Manufacturers' Association held at Vienna, may be obtained at the meeting, or will be sent free on application to this Association, Postoffice Box 3672, Boston, Mass.

The Secretary read the records of the last meeting, held at the New Willard Hotel, Washington, D. C., October 3 and 4, 1907, and on motion of Mr. JOHN GREGSON, the same were approved.

The SECRETARY. Mr. President, it is my duty to announce that after the close of this meeting the terms of the following officers expire by limitation:

PRESIDENT.

WILLIAM D. HARTSHORNE.

VICE PRESIDENTS.

CHARLES T. PLUNKETT,
GEORGE OTIS DRAPER.

DIRECTORS.

ROBERT BEATTY,
FREDERICK A. FLATHER,
ROSCOE S. MILLIKEN.

This awaits the pleasure of the meeting.

Mr. CHARLES H. FISH. Mr. President, I move that the President appoint a committee to nominate officers for the ensuing year.

The motion was seconded and adopted, and the President appointed the following as the Committee on Nominations: J. R. MONTGOMERY, chairman, Windsor Locks, Conn.; ARTHUR O. DAWSON, Montreal, Canada; Gen. WILLIAM AMES, Providence, R. I.; RUSSELL W. EATON, Brunswick, Me.; DANIEL MOORE BATES, Wilmington, Del.; WILLIAM T. WESTERMAN, Philadelphia, Penn.; EDWARD W. THOMAS, Baltimore, Md.; DANIEL A. TOMPKINS, Charlotte, N. C.

The PRESIDENT. There is another committee which ought to be appointed at this time, the Committee on Resolutions. Has any one a motion to make on that point?

Mr. JAMES R. MACCOLL. Mr. President, I move the appointment of a Committee on Resolutions.

The motion was seconded by Mr. CHARLES H. FISH and adopted, and the President appointed the following as the Committee on Resolutions: JAMES R. MACCOLL, chairman, Providence, R. I.; WALTER E. PARKER, Lawrence, Mass.; GEORGE

OTIS DRAPER, Hopedale, Mass.; JOSEPH MERRIAM, Middletown, Conn.; WILLIAM L. LYALL, Passaic, N. J.; JOHN P. WOOD, Philadelphia, Penn.; EDWIN FARNUM GREENE, Boston, Mass.; JOHN B. WILD, Utica, N. Y.; BROADUS E. WILLINGHAM, Macon, Ga.

The PRESIDENT. The next in order is the report of the Secretary.

THE SECRETARY'S REPORT.

The additions to the membership have been greater during the past year than that of any year in its history, with one exception; but the numerical increase in membership is not a full measure of its growth because the influence resulting from the force of larger numbers applies to a wider scope, and has imposed upon this organization certain added duties and even responsibilities in respect to the interests of its members.

It has always been the policy of this Association to attend to such needs even to the smallest details, as an organization must be managed upon such a policy that membership in it will be distinctly advantageous to those who are competent to be of its number.

A careful tabulation of the relations of each of its members as indicated by their positions was made last summer and showed that a majority were in positions whose responsibilties were upon the financial side of cotton manufacturing, and this was without any diminution of their duties pertaining to the technical side of the industry.

The growth of the industrial unit and the competitions of more extensive lines of manufacture, and also those of wider markets have increased the responsibilities of those in charge of such establishments particularly in connection with systematic methods of organization without which the management of a large mill would involve duties beyond the physical strength or the mental capacity of any one individual.

The establishments whose managers comprise the membership of this Association amounted last July to 17,157,637 spindles;

1,472 sets of woolen and worsted cards: 5,849 knitting machines and 67 printing machines; and these with the industries represented in the associate membership, amounted to a capital of $734,586,700. A careful estimate of the net accessions since that time warrants the belief that the capitalization represented at the present time is over $750,000,000.

This Association has received a greater number than usual of requests to affiliate with other organizations, especially in various patriotic and commercial movements of undoubted merit; but the Board of Government as heretofore have continued to avoid any such affiliations, because, irrespective of other conditions, this is an Association of individuals and not of manufacturing establishments.

During the past year the Association has to a certain extent deviated from previous customs upon which there were no rules to the contrary, when the condition of legislation relative to the establishment of forest reservations by the Federal Government in the White Mountains and eastern slope of the Appalachians was brought to its attention. The importance of a uniform water supply by forests conserving the rainfall which it gives out in the summer and mitigates the severity of low water during the warm months has been a matter which all manufacturers using water power have long viewed with the most serious apprehension.

At the annual meeting of April 26, 1906, the Association passed resolutions in favor of such legislation. Three bills providing for this measure have passed the United States Senate, but have failed to pass the House and it was felt by many that this failure has been due to the fact that the importance of the measure to the manufacturing interests of the country and the employment of labor which their operation implies had not been fully set forth by the manufacturers.

Your secretary and four of the members attended a hearing and have presented this side of the matter to the Committee on Agriculture, by whom it is believed that these facts have received careful consideration. The Association has also sent to the

members information upon this forestry bill and also other proposed legislation which would be of great importance to all furnishing supplies to the Federal Government, in order that they may individually act upon the matter according to their own wishes.

THE INTERNATIONAL CONFERENCE OF MASTER COTTON SPINNERS AND MANUFACTURERS.

At the initiative of this Association, the American Association of Cotton Manufacturers, the Southern Cotton Association, and the Farmers' Educational and Co-operative Union joined with it in calling for a Second International Conference of Cotton Growers and Manufacturers, which was held at Atlanta, Georgia, in the Hall of Representatives on October 7 and 9, 1907. At this meeting was one hundred and eighteen European cotton manufacturers and their guests, also representatives from the Boards of Trade and other commercial organizations throughout the cotton producing states.

A further description of the meeting is contained in Volume 83 of the Transactions, page 287; and also the consensus of opinion of that Conference which was represented by resolutions which were unanimously adopted, as the rules require that in case of any difference, the vote should be by the organizations represented.

It devolved upon this Association to make the arrangements for the meeting and also those for special train conveying them over a route of 4,700 miles in length, and the receptions at various cities which they visited.

In accordance with the vote passed at this Conference asking that each of the associations appoint two delegates to the Executive Committee of the Conference, the President and Secretary were appointed by the Board of Government, *ex-officiis*, with power of substitution. The English Federation of Master Cotton Spinners' Associations, Limited, and also the European Continental organizations represented in the International Federation of Master Cotton Spinners' and Manufacturers' Associations have

not as yet appointed any delegates and the matter has been left in abeyance until their meeting to be held at Paris, June 1, 1908, shall take up the question. The invitation that this Association should send five delegates to the meeting in Paris has been accepted by the Board of Government, which voted that the President should select the delegates.

CONFERENCE ON TRUSTS AND COMBINATIONS.

The Secretary of this Association was appointed by His Excellency CURTIS GUILD, Jr., Governor, as a delegate to represent the Commonwealth of Massachusetts at the Conference on Trusts and Combinations, held at Chicago, Illinois, October 22 to 25, 1907. The opinion of that Conference expressed in its resolutions was considered to be broadly representative of conservative public opinion on many questions which are receiving careful attention. The function of your Secretary in that connection was in the nature of preventing certain lines of resolutions which he believed were not necessary for the welfare of the country at that time.

THE ASSOCIATION MEDAL.

The Association Medal for the year 1907, was awarded to CHARLES B. BURLEIGH, of Boston, Massachusetts, for his paper on the Curtis Vertical Steam Turbine; the Committee on Award being CHARLES T. PLUNKETT, GEORGE A. AYER, CHARLES T. MAIN, and SIDNEY B. PAINE. The committee for the present year are CHARLES B. BURLEIGH, chairman; W. IRVING BULLARD, NATHANIEL B. KERR and CHARLES T. MAIN, who will make the report, announcing their award of the medal at this coming meeting.

This Association Medal was established by a trust which the Association April 26, 1898, adopted on the action of the Board of Government in applying the income of the funds established in 1895 for this purpose as is recorded in Volume 68 of the Transactions, page 79. The recipients of this medal have been

CHARLES H. FISH, 1901; SIDNEY B. PAINE, 1902; WILLIAM D. HARTSHORNE, 1903; DANIEL MOORE BATES, 1904; HENRY G. KITTREDGE, 1905; WILLIAM D. HARTSHORNE, 1906; CHARLES B. BURLEIGH, 1907.

THE STUDENT'S MEDAL.

The Students' Medals for the encouragement of textile education which is supported by a fund donated for that purpose by the late MOSES PIERCE of Norwich, Connecticut, in commemoration of his ninety-second birthday, July 3, 1900, have been awarded during the year to LLOYD L. DELANO, New Bedford, Massachusetts, a graduate of the New Bedford Textile School; JAMES GROESBECK COMAN. Lowell, Mass., a graduate of the Lowell Textile School; THEODORE ECKHARDT RAHT, 710 Prospect Street, Chattanooga, Tennesee, a graduate of the Textile Department of the Georgia School of Technology; JOEL ROBERT BAKER, 150 East Fourth Street, Oswego, New York, a graduate of the Philadelphia Textile School.

The method of awarding the student's medals was changed a year ago by vote of the Association and in place of special committees of the members appointed by the Board of Government to make the examination and also the decision, certain rules were adopted and sent to all of the known textile schools in the United States.

The replies, both those of correspondence and the published reports of these schools have been examined by a committee of the Board of Government, consisting of Messrs. ROBERT BEATTY and GEORGE P. GRANT, Jr., who reported that the following textile schools conform to the conditions established by this Association for the awarding of this medal to the pupil in the graduating class having the highest general excellence: The New Bedford Textile School, New Bedford, Massachusetts; The Philadelphia Textile School, Philadelphia Pennsylvania; The Textile Department of the North Carolina College of Agriculture and Mechanical Arts, West Raleigh, North Carolina; and as the Board of Government adopted their report, the Association will

present the medals to the three students of highest general excellence in the above institutions at their forthcoming graduation.

THE FIRTH SCHOLARSHIP.

The scholarship established by the Association from the contribution of WILLIAM FIRTH, Esq., sustains a student at the New Bedford Textile School. The present recipient of this scholarship will graduate in June, 1908, and the income will be available for the education of another student which, under the conditions of the deed of trust establishing this scholarship, is to be given preferably to the son of a member or of a deceased member of this Association. The Association gives this as a notice that it is ready to give information of detail respecting this scholarship and invites applications for the same.

LIFE MEMBERSHIP.

Immediately after the close of the present fiscal year, FREDERICK A. FLATHER became a life member, making the whole number of life members fifteen.

MEMBERSHIP.

During the past year the following eleven members have died: HENRY B. ASHTON, BRADFORD C. DIVINE, FRANK H. DWELLY, HENRY S. HOUGHTON, Jr., ALBERT F. KNIGHT, STEPHEN A. KNIGHT, ALVIN S. LYON, JOHN TEMPEST MEATS, A. CURTIS TINGLEY, FRANK P. VOGL, SAMUEL WEBBER, biographical sketches of whom will appear in the Transactions.

Colonel SAMUEL WEBBER, an honorary member of this Association, died at his home in Charlestown, New Hampshire, February 23, 1908, at the age of eighty-five; and the Board of Government adopted the following resolutions:

"RESOLVED: That, this minute be entered on the records to the memory of Colonel SAMUEL WEBBER who died February 23, 1908.

He was one of the organizers and the first Secretary of the Hampden County Cotton Spinners' Association in 1854, the progenitor of this Association, of which he was an honorary member.

Colonel WEBBER had a brilliant career of many years as a cotton manufacturer, being a pioneer in the introduction of new and technical methods which connected the earlier primitive customs of manufacturing with those now in use.

Among his work of especial value may be noted that of the treatment of copper rolls for printing fabrics, his observations of European methods of manufacture, the presentation of American textile interests in connection with numerous large expositions which have been held in this country, and also his work as a compiler of industrial statistics.

He made many measurements of water-powers and tests of wheels introducing methods which were of especial value in suggestion of improvements and the comparative record of the present with the past. His measurements of power required by shafting and the various textile machines are of great value as records of this day, and he was one of the pioneers on the transmission of power by belting.

Much of his work outside of the routine of manufacturing in which he made numerous developments has been contained in his published works which thus preserved in permanent form many of the investigations which are referred to above."

There have been eighteen resignations and ten dropped for non-payment of dues. On April 1, 1907, the membership was 879, and during the the year 126 have been elected, with the number as stated above, the membership on April 1, 1908, was 961.

Appended to this report the Transactions will contain the membership on May 1, 1908, including the admissions at this meeting and deducting any diminutions of membership during this month. Since April first, twenty-two have resigned, one died, and fifty-five have been elected, in addition to two transferred by election from Associate to Active membership making the total membership May 1, 1908, 993.

MEETINGS.

The Association has held two meetings during the past year, one in Boston, April 24 and 25, 1907, and one at Washington, October 3 and 4, 1907. The latter occasion was graced by the presence of one hundred and eighteen English and Continental cotton manufacturers as guests of this organization.

The Board of Government has held eight meetings during the past fiscal year at which directions have been given for the many affairs necessary for the conduct of this Association. The Association appreciates the necessity of the co-operation of its members in every respect and invites suggestion and comment at all times from the members.

LIBRARY.

One of the functions of this organization, as stated in the Charter, is to collect a library on textiles, to which there have been contributions in the past. It is hoped that each member of the Association will contribute to this library a copy of any books on textiles which he may have written, and beyond that copies of other books on textiles will be gratefully received.

The library is in receipt of the following Transactions of Associations and periodicals:

American Cotton Manufacturers' Association,	Charlotte, N. C.
American Society of Civil Engineers,	New York.
American Society of Mechanical Engineers,	New York.
American Institute of Electrical Engineers,	New York..
Boston Chamber of Commerce,	Boston.
Bureau of American Republics,	Washington, D.C.
Consular Reports, Bureau of Statistics,	Washington, D.C.
National Association of Wool Manufacturers,	Boston.
National Electric Light Association,	New York.
Western Society of Civil Engineers,	Chicago.

PERIODICALS.

American Economist,	New York.
American Textile Manufacturer,	Charlotte, N. C.
American Industries,	New York.
American Wool and Cotton Reporter,	Boston.
Boston Journal of Commerce,	Boston.
Cassier's Magazine,	New York.
Cotton,	Atlanta.
Cotton,	Manchester, Eng.
Daily Trade Record,	New York.

Dry Goods Economist,	New York.
Electrocraft,	Detroit.
Engineer,	Chicago.
Engineering News,	New York.
Engineering Record,	New York.
Fibre and Fabric,	Boston.
Iron Age,	New York.
Journal of the Franklin Institute,	Philadelphia.
Journal of the Municipal School of Technology,	Manchester, Eng.
Lowell Textile Journal,	Lowell, Mass.
Machinery,	New York.
Manufacturer,	Philadelphia.
Manufacturers' Record,	Baltimore.
Mill and Shop,	Boston.
National Electrical Contractor,	Utica.
National Civic Federation Review,	New York.
New England Shoe and Leather Association Monthly Gazette,	Boston.
New York Commercial,	New York.
Posselt's Textile Journal,	Philadelphia.
Power,	New York.
Practical Engineer,	Philadelphia.
Protectionist,	Boston.
Railway and Marine News,	Seattle, Wash.
Technical World,	Chicago.
Textile American,	Boston.
Textile Manufacturers' Journal,	New York.
Textile Recorder,	Manchester, Eng.
Textile World Record,	Boston.
Valve World,	Chicago.

Respectfully submitted,

C. J. H. WOODBURY,

Secretary.

April 16, 1908.

On motion of Mr. HAVEN C. PERHAM, seconded by Mr. CHARLES H. FISH, the report of the Secretary was accepted and ordered placed on file.

APPENDIX.

MEMBERSHIP OF THE ASSOCIATION.

No. of Meeting	DATE OF MEETING.	Membership.	Number of Present Members.	Number Elected to Membership.
1	April 20, 1865, Boston, Mass.	44	1	44
	July 19, 1865, Adjourned Meeting	. .	2	42
2	July 18, 1866, Boston, Mass.	72	0	0
3	July 17, 1867, " "	. .	1	10
4	Jan. 15, 1868, " "	108	0	32
5	July 15, 1868, " "	. .	1	12
	Oct. 21, 1868, Adjourned Meeting	. .	0	6
6	April 21, 1869, Boston, Mass.	. .	0	19
7	Oct. 20, 1869, " "	. .	1	8
8	April 20, 1870, " "	144	0	12
9	Oct. 19, 1870, " "	. .	0	5
10	April 19, 1871, " "	. .	0	9
11	Oct. 18, 1871, " "	. .	1	16
12	April 17, 1872, " "	166	4	29
13	Oct. 16, 1872, " "	. .	3	14
14	April 16, 1873, " "	175	1	13
15	Oct. 15, 1873, " "	. .	3	17
16	April 15, 1874, " "	189	1	13
17	Oct. 21, 1874, " "	. .	0	7
18	April 21, 1875, " "	199	1	13
19	Oct. 27, 1875, " "	. .	2	18
20	April 26, 1876, " "	200	0	11
21	Oct. 25, 1876, " "	. .	1	13
22	April 25, 1877, " "	213	3	20
23	Oct. 31, 1877, " "	. .	1	9
24	April 24, 1878, " "	210	3	8
25	Oct. 30, 1878, " "	. .	1	11
26	April 30, 1879, " "	205	3	10
27	Oct. 29, 1879, " "	. .	5	16
28	April 28, 1880, " "	219	2	14
29	Oct. 27, 1880, " "	. .	1	13
30	April 27, 1881, " "	231	1	11
31	Nov. 30, 1881, " "	. .	1	6
32	April 26, 1882, " "	231	1	9
33	Oct. 25, 1882, " "	. .	2	5
34	April 25, 1883, " "	240	3	15
35	Oct. 31, 1883, " "	. .	2	10
36	April 30, 1884, " "	247	2	9
37	Oct. 29, 1884, " "	. .	2	2
38	April 29, 1885, " "	225	2	3
39	Oct. 28, 1885, " "	. .	4	8
40	April 28, 1886, " "	225	3	7
41	Oct. 27, 1886, " "	. .	4	8
42	April 27, 1887, " "	234	3	10
43	Oct. 27, 1887, " "	. .	2	3

No. of Meeting	DATE OF MEETING.	Membership.	Number of Present Members.	Number Elected to Membership.
44	April 25, 1888, Boston, Mass.	241	8	15
45	Oct. 31, 1888, " "	. .	5	12
46	April 24, 1889, " "	242	3	6
47	Oct. 30, 1889, " "	. .	4	8
48	April 30, 1890, " "	246	4	7
49	Oct. 29, 1890, " "	. .	6	11
50	April 29, 1891, " "	254	2	4
51	Oct. 28, 1891, " "	. .	5	8
52	April 27, 1892, " "	244	9	12
53	Oct. 26, 1892, " "	. .	12	19
54	April 26, 1893, " "	259	3	11
55	Oct. 25, 1893, " "	. .	6	9
56	April 25, 1894, " "	270	7	16
57	Sept. 27—28, 1894, Crawford House, N. H.	292	10	19
58	April 24—25, 1895, Providence, R. I. . . .	383	61	92
59	Oct. 24—25, 1895, Atlanta, Ga.	422	26	46
60	April 29—30, 1896, Boston, Mass.	450	16	29
61	Sept. 22—24, 1896, Profile, House, N. H. .	459	10	19
62	April 28—29, 1897, Boston, Mass.	495	30	43
63	Oct. 27—28, 1897, Philadelphia, Pa. . . .	523	20	38
64	April 27—28, 1898, Boston, Mass.	535	10	24
65	Sept. 27—29, 1898, Crawford House, N. H.	554	7	16
66	April 26—27, 1899, Boston, Mass.	504	22	33
67	Oct. 5— 6, 1899, Montreal, P. Q.	580	13	22
68	April 25—26, 1900, Boston, Mass.	603	26	38
69	Oct. 16—18, 1900, Washington, D. C. . .	628	24	38
70	April 24—25, 1901, Boston, Mass.	647	24	33
71	Sept. 25—26, 1901, Niagara Falls.	661	12	19
72	April 23—24, 1902, Boston, Mass.	681	31	42
73	Sept. 30—Oct. 2, 1902, New York	699	19	24
74	April 22—23, 1903, Boston, Mass.	706	33	41
75	Sept. 29—Oct. 1, 1903, Lenox, Mass. . . .	723	22	27
76	April 27—28, 1904, Boston, Mass.	744	29	41
77	Sept. 21—22, 1904, Bretton Woods, N. H. .	761	21	25
78	April 26—27, 1905, Boston, Mass.	755	33	36
79	Sept. 20—21, 1905, Atlantic City, N. J. . .	820	65	71
80	April 25—26, 1906, Boston, Mass.	876	75	79
81	Sept. 12—13, 1906, Lake Champlain	896	29	31
82	April 24—25, 1907, Boston, Mass.	961	85	91
83	Oct. 3 — 4, 1907, Washington, D. C. . .	985	34	35
84	April 16—17, 1908, Boston, Mass.	993	51	53

TREASURER'S REPORT.

C. J. H. WOODBURY, TREASURER, IN ACCOUNT WITH THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.

April 1, 1907 to April 1, 1908.

DEBTORS.

Cash,	$339 30	
Active membership dues,	3,475 00	
Associate membership dues,	1,810 00	
Active admission fees,	940 00	
Associate admission fees,	525 00	
Interest, *	74 82	
Sale of Transactions,	414 05	
Telephone,	3 70	
Advertising,	1,058 00	
International Conference of Cotton Growers and Manufacturers,	502 27	
Loan (less discount)	1,494 50	
Tickets and Subscriptions to Annual Banquet,	442 25	
Engraving,	2 20	
Lunch to Foreign Cotton Mfrs. at Washington,	388 00	
		$11,469 09

CREDITORS.

Board of Government,	$430 33	
Office rent,	399 96	
Secretary and Treasurer,	$2,000 02	
Reports of meetings,	169 82	
Notices and stationery,	330 86	
Amount forward,		$3,330 99

*In addition, the interest on the Savings Bank Book accrued, but not drawn, amounts to $76.42

Brought forward,	$3,330 99	
Meeting expenses, including Annual Banquet,	512 97	
Printing and distributing Transactions,	2,994 78	
Engraving,	82 41	
Badges,	103 85	
Miscellaneous,	31 35	
Postage, telephone and express,	233 04	
Advance copies of papers,	656 50	
Office supplies and furniture,	42 13	
Stenographer and proof,	859 90	
Medals and certificates of membership,	268 42	
Forest Reservation Legislation,	113 13	
International Conference of Cotton Growers and Manufacturers,	1,202 09	
Subscriptions to lunch to Foreign Cotton Manufacturers at Washington,	388 45	
Cash,	339 30	
		$11,159 31

The Association holds the following funds for the specific purposes as set forth, and the income during the past fiscal year is as follows:

	PRINCIPAL.	INCOME.
Life membership fund,	$1,400 00	$58 81
Associate medal and certificate fund,	1,000 00	42 01
Student's medal fund, Donation of Moses Pierce),	200 00	8 41
Library fund, (Bequest of George W. Weeks,)	1,000 00	42 01
Textile scholarship fund, (Donation of William Firth,)	3,000 00	
	$6,600 00	$151 24

The principal of this fund is held in trust by the Treasurer of the New Bedford Textile School and the income sustains the scholarship in accordance with the provisions of the deed of trust executed by this Association and the New Bedford Textile School, February 20, 1902.

Invested as follows:

Bonds, (market value April 1, 1908, $1,975),	$1,935 11	
Deposited in Savings Banks,	1,364 89	
Deposited in Trust Company,	300 00	
Held in trust by treasurer of the New Bedford Textile School,	3,000 00	
		$6,600 00

AUDITOR'S REPORT.

I hereby certify that the amounts from April 1, 1907, to April 1, 1908, are correctly cast, that all payments are properly vouched for, that the funds are kept in deposit in the name of The National Association of Cotton Manufacturers, and that the amount of the deposit April 1, 1908, agrees with the balance in the books viz., $339.30.

The securities in which the Association funds are invested have been examined.

C. E. ROBERTS,
Auditor.

BOSTON, MASS., APRIL 7, 1908.

The earnings of the Association for the year may be placed as:

695 active dues at $5,	$3,475 00	
181 associate dues at $10,	1,810 00	
94 active admission at $10,	940 00	
21 associate admissions at $25,	525 00	
Advertising,	1,385 00	
Miscellaneous,	1,439 29	
		$9,574 29

Bills receivable:

Active dues and admission,	$1,110 00	
Associate dues and admission,	635 00	
Advertising,	702 00	
		$2,447 00

EXPENSES.

The expenses of the year have increased not merely on account of those legitimately applying to this Association on

account of the International Conference of Cotton Growers and Manufacturers held at Atlanta, but because this Association has not been fully reimbursed by the others affiliated with it. It was agreed that this Association should assume in excess of its divisional share of the expenses, the excess above a thousand dollars on account of its initial work, which, however, did not include a material part of the office expenses and correspondence which are inevitable with such assemblies. Four American associations united in the call to the Conference and at the meeting and one other association was admitted by vote, but afterwards declined to pay its share for the Atlanta Conference although expressing its willingness to do so in the event of a future conference.

Therefore, the expenses of one thousand dollars were divisible by four and not by five, of which this Association contributed one share. Another organization has not yet fulfilled its promise to pay its contribution. In addition the expenses relative to the action of this Association pertaining to forestry legislation, have been $113.13, making a total additional expense for the year of $815.22.

While this is not a large amount, it should be remembered that it has been the policy of this Association not to accumulate funds, but to apply its income for the benefit of its members and in addition to this the income from interest on funds and advertisements enable expenditures as stated in the Treasurer's report of a year ago to be thirty-six per cent. more than the members paid to the Association during the year.

This failure to collect bills receivable and also the delays of dues and the additional expenses mentioned above forced the Association to obtain a loan of $1,500, late in its fiscal year.

There are no bills payable other than the above note which has been paid since April first.

The income derived from advertisements has enabled the Association to be conducted on the same basis as other technical organizations which are supported by higher assessments as well as by advertisements in their transactions. The earnings

from this source have amounted in the several volumes of the Transactions to:

63	Philadelphia, October 1897,	$385 00
64	Boston, April, 1898,	420 00
65	Crawford House, September, 1898,	450 00
66	Boston, April, 1899,	550 00
67	Montreal, October, 1899,	445 00
68	Boston, April, 1900,	580 00
69	Washington, October, 1900,	665 00
70	Boston, April, 1901,	620 00
71	Pan-American, September, 1901,	595 00
72	Boston, April, 1902,	575 00
73	New York, September — October, 1902,	645 00
74	Boston, April, 1903,	745 00
75	Lenox, September — October, 1903,	705 00
76	Boston, April, 1904,	616 00
77	Bretton Woods, September, 1904,	650 00
78	Boston, April, 1905,	460 00
79	Atlantic City, September, 1905,	620 00
80	Boston, April, 1906,	715 00
81	Lake Champlain, September, 1906,	685 00
82	Boston, April 1907,	685 00
83	Washington, October 1907,	700 00
84	Boston, April, 1908, (already under contract,)	425 00

MEMBERSHIP.			TRANSACTIONS.			FINANCES.				
Fiscal Year Ending April 1.	Enrollment.	Members Elected.	Volume Number.	Pages in Volume.	Pages for Year.	Cash Receipts.	Expenses.	Cost per Page of Transactions.	Cost per Member.	Cost per Page of Transactions for each member Cents.
1891	246	18	48 49	43 62	105	$1,142 00	$ 920 08	$8 82	$3 76	3.59
1892	254	12	50 51	129 60	189	1,200 08	1,374 40	7 27	5 41	2.86
1893	244	31	52 53	63 94	157	1,678 33	1,603 25	12 22	6 57	6.33
1894	259	19	54 55	84 86	170	1,414 58	1,807 60	10 63	7 03	4.14
1895	270 292	35	56 57	73 230	303	1,947 07	1,957 64	6 46	6 71	2.21
1896	384 422	142	58 59	310 327	637	4,579 19	3,636 31	5 71	8 59	1.34
1897	450 459	49	60 61	269 359	628	3,710 02	3,980 34	6 33	8 67	1.43
1898	495 523	83	62 63	353 453	806	4,717 08	4,333 85	5 38	8 28	1.18
1899	535 554	42	64 65	321 380	701	4,713 56	4,775 97	6 81	8 62	1.23
1900	564 580	56	66 67	464 296	760	5,237 53	5,007 23	6 57	8 63	1.14
1901	603 628	78	68 69	382 476	858	6,331 93	6,295 55	7 34	10 02	1.16
1902	647 661	52	70 71	366 379	745	6,724 23	6,035 84	8 10	9 13	1.22
1903	681 699	66	72 73	342 415	757	6,768 81	6,701 65	8 85	9 58	1.26
1904	706 723	68	74 75	512 374	886	6,794 50	6,848 75	7 73	9 47	1.07
1905	744 761	66	76 77	376 313	689	7,080 31	6,797 04	9 86	8 93	1.29
1906	755 819	107	78 79	382 337	719	8,209 56	7,555 67	10 51	9 23	1.35
1907	876 896	110	80 81	429 387	816	9,060 93	8,560 09	10 49	9 55	1.17
1908	961 985	126	82 83	445 336	781	9,635 20	10,820 01	13 85	10.98	1.40

Respectfully submitted,

C. J. H. WOODBURY,

Treasurer.

April 7, 1908.

On motion of Mr. STEPHEN N. BOURNE, the Auditor's report was accepted and ordered placed on file.

On motion of Mr. CHARLES H. FISH the Treasurer's report was accepted and ordered placed on file.

Mr. PRESIDENT. The next item on the programme is the award of the Association medal, and I will call upon Mr. CHARLES B. BURLEIGH, Chairman, to submit the report.

THE REPORT OF THE ASSOCIATION MEDAL COMMITTEE.

Mr. CHARLES B. BURLEIGH. The committee appointed to award the Association medal for the year 1907, in accordance with the provisions governing the bestowal of this token of exceptional merit, have attended to the duty assigned them and after carefully reviewing the record of the transactions of the Association for the past year feel that the paper as recorded on page 134 of volume 83, entitled General Questions of Cotton Mill Fires, by Mr. CHARLES H. FISH, stands out so prominently to the advantage of the textile industry as to justly merit the award. [Applause.]

Addressing Mr. FISH:

Mr. FISH, In presenting you this silver medal you have so justly merited, I feel that your associates all join in thanking you for the thought and work you have always devoted, not only to their welfare but to the industry as a whole, and as they have been offered an opportunity for benefiting from your careful study and explicit recommendations in connection with your own misfortune, in the loss of your mill by fire, I trust that this medal may always remind you that some clouds, if not all, have a silver lining. [Applause.]

Mr. CHARLES H. FISH. *Mr. President, Mr. Chairman and Gentlemen of the Association:* I am certainly deeply grateful for this additional honor which you have seen fit to bestow upon me. My long connection with and my interest in the Association lends additional value to this medal. It is as your Chairman says, an ill wind that blows no good, for without the experience of a dreadful fire I certainly never could have aroused sufficient interest in that subject, or I doubt perhaps in any sub-

ject, to have warranted a paper which could have brought me this award. I wish that I might express in words exactly how I feel, but it is very difficult for me to do so and I beg to be allowed to simply say that I thank you very much and I trust that you all feel as the committee felt, that the award has been rightly placed. [Applause.]

The PRESIDENT. I think I may speak for the Association in saying that we all agree with the verdict of that committee.

A year ago Dr. PRITCHETT welcomed us to this institution. We have with us today his worthy successor — a well known chemist, perhaps even better known abroad than in this country— who has been long connected with the Institute of Technology, and he will give us the address of welcome. I beg to introduce Dr. ARTHUR A. NOYES, acting president of the Institute of Technology. [Applause.]

ADDRESS OF WELCOME TO THE NATIONAL ASSOCIATION OF COTTON MANUFACTURERS.

ARTHUR A. NOYES, Ph.D., Acting President, Massachusetts Institute of Technology.

Mr. President and Members of the Association :

It gives me great pleasure to extend to you a welcome to the halls of this institution, because this Institute, has from its foundation, aimed to keep in closest touch with the industrial interests of this country and this Commonwealth and because we appreciate this opportunity of knitting more closely the bonds which naturally unite a technological school with a society of manufacturers of the progressiveness and vitality which are such obvious characteristics of your Association. In looking over your programme I have been much impressed with the importance and variety of the questions which are to be discussed at your meetings here, and also with the close relation which exists between many of them and the work of this institution. While it is true that our courses of instruction deal with the scientific principles underlying the various industries rather than the specific knowledge pertaining to any one of them, yet the textile industries are of such importance that we do provide for some specialization in this direction and we use extensively as a means of emphasizing and illustrating general principles the applications that are made of them in the cotton manufacture. Thus the principles of mechanism are illustrated by their application to cotton machinery and those of mill engineering by their application to cotton-mill construction; while the most important part of our textile coloring course naturally consists in the dyeing and printing of cotton.

We, therefore, perhaps have a more direct connection with the cotton industry than with any other single branch of manufacture.

This reference to general and special training leads me to speak of the important but frequently misunderstood relation of the technological graduate to the work of the manufacturer. I am glad to have the opportunity to do this, for doubtless many of you are employers of such graduates, or, if not, come frequently into close touch with them. The manufacturer has, I fear, too often the feeling that the engineering graduate is unpractical and can therefore be of little use to him. This feeling, perhaps, arises because it is found that the graduate is at first ignorant of many of the technical operations and practices which are familiar to other subordinates who have grown up in the works. It should, I believe, be fully appreciated both by the manufacturer and the graduate that no attempt has been made to give the student this technical knowledge; and, therefore, it must be expected that he will have to go through a practical apprenticeship in the works for some weeks or months, before he can make his knowledge and training fully effective. But it should, on the other hand, be realized that he has a foundation of scientific knowledge and a scientifically trained mind which, after he has had a certain amount of practical experience, can not fail to be of the greatest value to the manufacturer in improving his processes and overcoming his difficulties. The latter, realizing this, will have some patience in waiting for results, and instead of insisting on an immediate economic return for his expenditure, will rather endeavor during the first few months to give the graduate such work as will afford him the practical information which he needs to round out his education. This procedure is already being followed by some of the large electrical and mechanical establishments in their practical courses for engineering graduates.

I believe, however, there is some danger of exaggerating the lack of practical knowledge and economic instinct which the graduates of engineering schools possess through failure to discriminate between his training and that given to students in the

academic colleges. From the beginning to the end of his Institute course, much of the mechanical engineer's work has been in the mechanic-arts shops and in large testing laboratories where boilers, machines and engineering materials are tested. In his study courses the economic bearing of principles and processes have been emphasized, and he has attended lectures devoted directly to such subjects as industrial organization and management, labor problems, and the organization of industry. Moreover, most of our students work during the long summer vacations in industrial establishments. So altogether they have at the time of graduation a not inconsiderable fund of practical and industrial experience, which the college graduate almost entirely lacks.

In closing, there is one other matter upon which I would like to say a few words. The function of this Institute is not confined to the training of engineers, but it is constantly carrying on in its laboratories through its instructors and students investigations upon industrial processes and materials; and we desire to extend our activities in this direction in order that we may be of as much service as possible in promoting the industrial development of the country. The close relation of many of the subjects on your program to our work suggests the idea that there may be problems or difficuties connected with your processes of manufacture which require for their solution a careful investigation; and I desire to say that our various departments will be glad to assist in this way as far as possible not only individual manufacturers of the Association, but also any committee of the Association which may at any time be charged with the study of any of your larger industrial problems.

In closing, I desire to express to you the appreciation of our Corporation and Faculty in selecting this institution for the place of your Annual Meeting and again to extend you a cordial welcome not only to this hall, but to any of our laboratories or shops which it may be of interest to you to visit.

The PRESIDENT. All citizens of Massachusetts have been greatly concerned in the illness of Governor GUILD, and before going on with the next address I would ask the Secretary to read a letter which was received from the Governor, possibly the last document which he signed before his illness became so severe.

The following letter was read by the Secretary.

Mr. C. J. H. WOODBURY, *Secretary*,
The National Association of Cotton Manufacturers,
Boston, Mass.

My dear Mr. Woodbury — I regret extremely that my doctor forbids me to accept any more invitations than those already contracted for during the months of March and April. The strain of legislative work is this year most unusual, as you doubtless appreciate, and I am dictating this letter from my bed. It being impossible for me to go away for even two or three days, I am obliged to take this kind of rest cure to recuperate from the wear and tear caused by the strain of evening addresses after ten hours' work at the State House.

In your case I know that my absence can be excused almost with satisfaction, as the Lieutenant Governor is so much better posted on cotton manufacturing than myself.

With many thanks for your courtesy and warm appreciation of past kindness, believe me,

Faithfully yours,

CURTIS GUILD, Jr.,
Governor.

March 6, 1908.

The SECRETARY. At the time that this invitation on the part of the Board of Government was given, it was expected that his Honor the Lieutenant Governor would grace the dinner this evening, leaving to His Excellency the Governor the attendance at this meeting this morning, but fate has compelled other arrangements by each of them.

The PRESIDENT. It is fitting, as has already been said, that the Lieutenant Governor, acting Governor, should occupy the position of welcoming this Association to this Commonwealth.

He is a gentlemen well known in the cotton industry as a member of the great firm of the Draper Company, manufacturers of the best machinery of its kind in the world, a graceful speaker and a valued member of this Association. I have the pleasure of introducing to you his Honor, EBEN S. DRAPER. [Applause.]

WELCOME TO THE COMMONWEALTH.

His Honor, EBEN S. DRAPER, Lieutenant Governor, Acting Governor, Hopedale, Mass.

Mr. President and Gentlemen of the Association — I think part of the introduction of the presiding officer was true. I admit that the Draper Company make the best machinery in the world. [Laughter]. I do not admit that the Lieutenant Governor is a graceful speaker. But he is certainly very glad to be here today in his official capacity to welcome to the Commonwealth of Massachusetts men representing this great industry with which he happens to be so familiar.

I was very much touched as this letter from Governor GUILD was read to you, because, as you were informed, it was dictated from his sick bed. He tried at that time, evidently, as he wrote this letter to give you the impression that he was taking a little vacation. His "little vacation," as we are all sorry to notice, turned out a very severe illness, and I am sure there is not a man within the sound of my voice who is not devoutly thankful to have received the good news which we have had from the Governor's bedside the last two or three days. He has been a very ill man, but I can say to you that the last news that we have received from his home is very hopeful and I sincerely hope that he will soon be able to resume his duties at the State House. [Applause].

I confess to you, gentlemen, that I come here today without proper preparation to make any speech of welcome. Times have been rather strenuous for the last few days for anybody who is connected with the State administration, and I should have hardly known what to say if it had not been for the kind-

ness of Mr. PRENDERGAST yesterday in sending me a circular. I presume some of you may have received it through the mail. It impressed me tremendously and I want to call your attention to some of the facts in this letter which he sent to me. It is headed:

SPINDLES AND LOOMS IN ENGLAND.

"From a statement just compiled in Manchester, Eng., we note that the increase in cotton spindles in England the last twelve months was 2,765,000, of which 541,000 were in Oldham alone. The total number of spindles in Lancashire is now 55,200,000 against 45,195,000 in 1904, an increase of 10,000,000 spindles in less than four years. In addition to the above there are twenty-five large mills in the process of erection. The increase in looms during the past twelve months has been 13,400. The total number of looms in England is 736,000 compared with 653,000 in 1904. The increase in spindles in the last twenty years has been nearly 15,000,000, and in looms nearly 200,000. In Oldham alone there are now nearly 15,000,000 spindles. Bolton has 7,000,000; Rochdale, 3,500,000; Stockport, 2,500,000 and Ashton under Lyne about 2,135,000."

MR. PRENDERGAST, as you know, is a very large broker and he gets in touch with the English news and sends these statements in regard to the English manufacturing out to various people at different times, and I have discovered that the information that he sends out is usually very authentic. And when I received this paper yesterday I made up my mind that I would speak for just a few moments about some of the remarkable statements that are made in this circular.

You will notice, in the first place, that the increase in looms does not compare with the increase in spindles. The increase in looms is normal — 12,000 or 13,000 in the year, but in the last five years there is an increase of 10,000,000 in the number of spindles.

You gentlemen are familiar with the cotton manufacturing industry in the United States. You know that there has been no increase to be mentioned in comparison with that in this

country, although business last year was tremendously successful. I think you will realize the reason why this great increase has taken place in England. There are many of our people that do not. It is because they can supply the nations of the East and of the continent of Europe with the products of their mills at a much less cost price than we can produce them.

Now, I do not propose to talk politics or tariff, but that statement is undoubtedly true, and you gentlemen can make up your minds where the lower cost comes in. They pay the same price for their cotton that you do and they get the cotton from the same market, but when we talk about expanding into the export trade of the East we do it on very coarse goods where the cotton is the great cost of the product. But when you come to the finest grades of goods you do not export many, and the reason for it is perfectly plain. I simply call attention to this fact so that you can see the enormous increase that has taken place in the cotton manufacturing industry in England. When I had the pleasure of speaking to you two years ago conditions in cotton manufacturing were not as they are today. I have been connected with this industry now for substantially thirty years, and I am sorry to say that I have never seen the conditions in the industry worse than they are today as far as business is concerned. Fortunately for all of us, last year was a splendid year in the business, and a great many of our mills took advantage of that situation to get into good financial condition. While I do not believe that we are going to have an immediate revival of business — you have a presidential election coming ahead of you; that usually does not stimulate business in my experience; and then after that you have the people of this country united substantially in a demand for tariff revision. That is all right, the people want it, but it will not help business while it is going on, and we want to realize that with those two great events before us business conditions must be unsettled for some time to come. I am not trying to make a pleasant speech, but I am trying to tell some truths, and I trust you gentlemen will excuse me for putting them so bluntly. I believe that you

are going to have upset conditions for some time in the future, and I also believe that this country is going to go on in the same path that it has followed in the past, and when a president has been elected and these matters have been straightened out and we have had a chance to get our bearings we are going to be as successful in the future as we ever have been in the past. [Applause.] There is no question about that in my mind. And I want to say further that I believe in manufacturing cotton that this section of the country is going to have just as great a place in the future in the manufacture of that great staple as it has in the past. Circumstances in the last few years have established that conclusively in my mind.

I have said a great deal more than I intended to say when I came here. It is always pleasant to get into association with old friends and you say more under those circumstances than you intend. My duty today was to welcome you to the Commonwealth of Massachusetts. I do not think you gentlemen need any welcome here. You are known here; most of you are part and parcel of us. You know that the Commonwealth of Massachusetts recognizes the value of a great industry, that she is interested in the great captains of industry who are doing so much to build up our towns and cities and the Commonwealth. And as her official representative today it is a great pleasure for me to extend the right hand of fellowship and to say that we are glad to see you here, we hope your stay in Boston will be pleasant and that your meeting will result in great benefit to all your members. I thank you for your kind attention. [Applause.]

PRESIDENT'S ADDRESS.

WILLIAM D. HARTSHORNE, Lawrence, Mass.

Fellow Members: —

At our Washington meeting I had the honor of presenting for your consideration the question of the effect of so-called industrial education on our industry. It was there conceded that all educational advantage was desirable, and would necessarily benefit in some measure our industry, ff we took proper advantage of its effect; but the question which seemed to me most to concern us was how to get good help into our mills, rather than how the industrial commissions were going to get them out, and into other occupations. There has been a great deal of discussion, and some effort at realization of plans for industrial trade schools, and there is evidence that the fact is somewhat appreciated that the textile industry may need a different training from that which is necessary and desirable for special trades in general; the primary difficulty being that where children are employed it is for purposes where grown persons are seldom available as learners. A report of the Massachusetts Commission on Industrial Education shows its recognition of this difficulty, at least in part, by recommending that a part-time system be provided for the textile schools, by which a boy might work in the mill for one week and his school-fellow the following. That is, alternately, week about: one in the mill and one in the school. This no doubt would have its advantages if it should prove practicable. Such children, however, as are generally available for work in the mill could not be accommodated in the textile schools proper, though they might be

receiving some industrial education elsewhere. Would it not be well, therefore, for their educational benefit, that our regular day school children, whose compulsory education has not yet been completed, should share in the opportunity for part-time work in some form, in order to learn not only what to do but how to work.

It should be further noted that this report takes into consideration the placing of all the State textile schools under the authority of the Industrial Commission, and efforts have been in progress, through bills before the Legislature, to re-organize the Industrial Commission, and to extend further the scope of its authority. The placing of the textile schools under this Commission, assuming it properly constituted, might perhaps give more effective results than we now have, through greater system in methods of teaching, and methods of co-operation with the manufacturer. But this step is one which should be considered with the greatest care, and it should not be forgotten that the local needs of textile schools in Fall River or New Bedford do not necessarily cover the same ground as those for a textile school in Lowell, or vice versa. The great variety of our industries both in cotton and worsted is such as to place cut-and-dried methods for the whole state, however effective they seem on paper, at some disadvantage for the locality, just as cut-and-dried methods in general educational work are not for the best advantage of every individual pupil. Such work, however, could be on co-ordinate or parallel lines, if not identical, and union of purpose is certainly desirable.

So far as the textile mill situation extends only to the ordinary operative, the fundamental requirement is an attitude of mind which is amenable to instruction and conscientious obedience. For some reason not well explained our public schools, excellent as they are, are not fully meeting this condition, and the parents of the children are not aiding the public schools as they should to bring this about. The home is perhaps the most at fault in the matter. Even the present scarcity of employment has not rendered either the younger portion of the community, or many

of their elders, amenable to systematic measures such as are necessary for the best success, and which our foreign competitors have acquired the ability to maintain. Such lack of educational success might have admitted of reasonable explanation when business was so pushing that every operative felt that it was only necessary to throw up his job to obtain another immediately. That present conditions have had some sobering effect, however, is clearly manifest, and this may eventually be represented in improved quality of production. The difficulty, however, is a fundamental one which seems to be prevalent throughout this country, and needs the most careful attention of our educational systems. With proper material to work with, and a willingness to co-operate, the training of operatives to take up more advanced positions would not only be possible, but ought to be of mutual benefit to both the operative and the mauufacturer. Such educational advancement must, however, require training both in the art and in the science of the occupation, and may well have the co-operation of textile schools, or industrial schools of some class.

One of the most important events in the past six months which our panic conditions unduly overshadowed was the Atlanta Conference. It was earnestly felt by those who took part in this Conference that it was an epoch-making event. The meeting together face to face of rival interests, and the formulating of resolutions covering so many details in regard to the cotton growing industry and the trade relations governing the same, where it was necessary for absolute unanimity to carry any resolution, was a noteworthy achievement. (These resolutions as passed may be found printed in the last number of the Transactions.) Manufacturers from the United States, many from across the water and representatives from the cotton exchanges met the planter upon his own ground and it is to the credit of the planter that he acknowledged without cavil the handicap which faulty methods had placed upon the cotton growing industry and which was reflected back against him by the serious results to the cotton spinner. Some of the methods of the

cotton exchanges received the strongest condemnation of both spinner and planter, but against efforts to legislate exchanges out of existence, wiser counsel prevailed.

It is to be regretted that the matter of permanent organizations has so far hung fire, only a few of the associations represented having appointed delegates. The first set-back came from the British Master Cotton Spinners' Association, a branch of the International Federation, who claimed that to multiply organizations would not be of benefit to the industry, their efforts being confined to endeavors to unite our manufacturing industries on this side of the water with the International Federation. This would seem practically impossible of attainment, even in a very limited way. Not all the interests of our manufacturers are by any means identical with those of our European friends, and it would seem that the only kind of unity of interest would be such as could be represented in periodical conferences, which it was the object of the permanent organization to foster and maintain. Possibly this matter may be taken up more advisedly at the European Conference at Paris which meets June next, and to which our Association has appointed five delegates, whom we trust will be able to return to us with valuable information there acquired.

One of the natural questions arising from the participation of the various Associations in this Conference at Atlanta is, how far our Association can unite its efforts with others in taking official action upon other matters than those simply technical? The Board of Government has been approached several times upon numerous subjects relating to legislative matters, but in which it seemed to them it was not within our province to take part. It must be remembered that we are an association of individuals and not of corporations or firms, and it has been our policy to avoid any entangling alliances which would in any way affect, either for good or ill, the financial policies of our several corporations. That it is possible, however, for us to make our influence felt, where it is proper to do so is evident in the efforts which have lately been made, under the sanction of the Board

of Government, to bring reliable evidence before the House of Representatives in regard to the great importance of preserving our rapidly diminishing forest reserves. At our annual meeting in April, 1906, resolutions were passed, and were made use of in this campaign, which is still in progress, towards effective legislation by Congress and at a hearing before the Committee on Agriculture at Washington, on Thursday, January 30, we were officially represented by our Secretary, C. J. H. WOODBURY and such eminent manufacturers as F. C. DUMAINE, Hon. ARTHUR H. LOWE, JAMES P. TOLMAN, and others, in such a way that the commercial side of this matter, as effecting the water power of our mills, was for the first time brought clearly to the attention of our legislators, and it is to be hoped that the individual efforts of each member of our Association, as suggested by a circular recently issued, will bear fruit. It should be remembered that this important measure, upon its own intrinsic merits, has twice passed the Senate, but for lack of something more than formal resolutions, has failed of recognition in the House. Resolutions which are not backed up by intelligent co-operation of individual effort are not likely to get or keep the attention of either law making or executive powers.

A subject upon which only our individual efforts could be employed was in reference to the Gardner Bill, of which you all no doubt have received official information. It is possible that one of our most effective ways of usefulness to the trade in general can be developed along the lines of spreading information to our members for their individual action, as has been done in reference to this particular bill. It is certainly desirable that the influence of our Association upon all matters of interest to the trade, not strictly confined to financial management should have an opportunity for recognition.

The question has been asked: What should be the attitude of this Association towards the seeming causes for our financial panic? So far as they are political, or relate strictly to the merchandizing side of the industry, we cannot, of course, take any united action, but even as individuals it may be worth our

while to reflect whether we consider that antagonism to evil conditions, or the evil conditions themselves have been the principal factor in bringing about our unpleasant situation. It may be assumed as axiomatic that without the evil conditions, efforts to overcome them would not have been required, and while it may be the part of wisdom to act with discretion, the element of valor must not be left out. It is evident that the people are not inclined to regard the house-cleaning efforts of the so-called big stick as responsible for the dirty house. On the other hand, those who are responsible for great financial undertakings are disposed to ask the question if in this effort to clean house it was necessary to raise such a terrible dust, spreading disease and disaster in its train. But regrettable and dangerous as this dust may be, has it not been blown away by the moral awakening of the nation? The primary confidence required for financial success lies with the people. Has not the knowledge that wrongs exposed (and perhaps yet to be exposed) will be righted under the full power of the law, been a great factor in preventing a total collapse of this confidence now happily being restored?

As regards the textile industry in general, and the cotton industry in particular, there is nothing to be said from a technical point of view, except to improve the opportunity for betterment of all mill conditions, and to keep courageously at work to this end.

The change of conditions of business since our meeting in Washington is certainly remarkable, and while the financial stress appears to be over, its after effects are far from complete adjustment, and the efforts to maintain marketable conditions by curtailment of production and reduction of wages seem for the time to be unavoidable. The lowering of the purchasing power of the laborer throughout the United States may have a temporary effect to further diminish the demand for goods, for which a diminution of supply is the economic offset. The insufficient supply of work is already returning to foreign shores many of those who have emigrated here: a temporary blessing

perhaps, for the distress of the unemployed in some of our cities is already serious. It is certainly incumbent upon every industry to act soberly and cautiously, but with a full degree of optimistic expectation.

Speculative efforts to raise the price of cotton in the face of the diminished demand have been meeting the natural result of such efforts, but a reaction to materially lower prices in cotton may not necessarily be an advantage to the cotton manufacturer, for its effect is discounted by the buyer, and this greatly increases the difficulty of maintaining contracts yet to be delivered.

All these relations, however, are ultimately readjustable, just as rapidly as confidence between buyer, seller and banker, and the general public can be fully restored, and possibly we as manufacturers will be soon welcoming back to our shores again, perhaps more greatly needed than ever, those whom we are now unable to keep employed.

In this matter of recuperation we must not forget that a great indebtedness is to be due the farmer, who supplies the main necessities of life. His purchasing power may be lessened by the general condition of the country, but he feeds the world, and he has had, and is likely to have, the necessary supply. As long as the farmer can be depended upon for this, no long depression seems possible, and we have a right to expect a future development for our whole country upon a firm basis of success, firmer perhaps than heretofore, because of the awakened sense of moral obligation: a cultivated inheritance to the many, but compelled to the few.

I thank you, gentlemen, for your attention.

The PRESIDENT. I wish to add a few words of comment. Our program has been prepared beforehand and those who are speakers thereon are either members or those who have been

invited by the Board of Government to make addresses before us. It will not be possible for us to hear other interpolated speakers in outside interests. There has been a great deal of effort made to get an opportunity to present subjects for the consideration of this meeting. This we will be enable to undertake in our limited time. Of course the Association is run for the benefit of its members and any advertising which is incidental of course is welcome, but it ought not to be made a feature of our meetings.

The gentleman who is about to address us was, as I understand, in his early childhood connected with one branch of the textile industry, that is, the woolen manufacturing. He began to work in the mill much earlier than is permitted now and probably worked according to the custom of the time much longer hours than any people do today in our mills. Yet by reason of his great energy he was enabled to obtain a thorough education, through night schools or otherwise; he has had an active and honorable business career, and is the head of a great manufacturing corporation. He is an authority on economic questions, has written numerous papers for the magazines and I believe is a lecturer before one of our colleges on this subject. He is now also exhibiting his business capacity as the first foreign-born mayor of the great city of Worcester. I have the pleasure of introducing to you the Hon. JAMES LOGAN. [Applause].

Hon. JAMES LOGAN. *Mr. President, Gentlemen:* I thank you for your invitation and for your kindly words of welcome to speak here today. I did begin working in a woolen mill rather young, before I was quite ten years of age, in those good old days of the past when we worked from five in the morning to seven at night and didn't think we were abused. There must be no preliminary remarks if you are going to hear my paper, Mr. President. The topic given to me is The Steadying Power and Influence of Consolidation.

THE STEADYING POWER AND INFLUENCE OF CONSOLIDATION.

HON. JAMES LOGAN, Mayor of Worcester, Mass.

Industrial consolidation is a many-sided problem with many conflicting interests, and hence it must be considered from many points of view, from each of which it presents a different aspect. No half-hour talk can do justice to even one phase of this, the largest commercial and economic problem with which business men have ever been called upon to wrestle, and one which has taxed and will continue to tax their abilities to the utmost.

The belief is quite general in certain directions that all combinations and consolidations are organized to stamp out competition and unduly advance prices.

Without doubt, many consolidations have been organized with that end in view; but there are many others which have been organized to correct abuses which on account of ignorance and lack of intelligence, had become fastened upon many lines of industry and which threatened their destruction. The fact is not lost sight of that the promoter has been one of the largest influences in the work of consolidation, but ignorant, unequal, even dishonest competition in business had brought many industries to such a condition that manufacturers were willing to listen to plans of the promoter, or to any scheme which gave promise of even partial relief.

A recent economic writer, from the seclusion of his study, far removed from the conflict of the great, busy world, a conflict which often anihilates theories, has written in glowing terms of the beauties of friendly competition; and another forceful writer

who, to quote in the slang of today, "was up against the real thing," said, in referring to this article, that the writer evidently had in mind a friendly war or, perchance, a peaceful hell. Present day competition is the same in kind that it always has been though it is different in degree. It is no holiday entertainment, — competition is sharp now but it is going to be infinitely sharper, and we shall not forget that competition is industrial war, and that ignorant, unrestricted competition, carried to its logical conclusion, means death to some of the combatants and injury for all. The law of war is that the strong and well equipped will succeed and the weak or poorly equipped will fail, — but size does not always indicate strength and efficiency.

The theory of some economic writers and teachers appears to be that combinations and consolidations are all wrong and live by wrong doing, but it does not follow that this theory is correct and there is an evident change in the thought of some in this respect. The *principle* of consolidation is right, but the *practice* of consolidation can be and sometimes is, wrong. The progress of the world has been the result of combination and consolidation; it is the working out of that principle which separates civilized man from the barbarian. It is the broad highway over which the human race has made progress to its present condition which, notwithstanding the great inequalities which still exist in human conditions is, we believe, the best the world has ever known.

There is only one way in which a consolidation can for any length of time be successful or in a degree eliminate competition, and no new principle is called into being to bring success. It is the same principle whether it be a consolidation of corporation, a single firm, a man or a boy. They must each render exceptional service if they would succeed. The consolidation must share the profit with the consumer by lowering the price. If it does not it will fail, and it deserves to fail if its policy is to create a fictitious value for its product, and to practically say to the public, "Stand and deliver."

The correct theory underlying modern industrial consolidation is greater economy in production, — a larger return of efficiency for effort expended, and not an artificial and uneconomic price for product. By a comparison of methods the management determines which is the best and most economical of all the several processes of manufacture, and then having found the best method, the effort is made to bring all the different branches or divisions up to the highest standard of efficiency.

Too many consolidations have been managed not in the interests of the stockholders, the consuming public, or employees (all of which have rights which must be respected), but in the interests of the stock speculators, and the industry is often ruined because more thought is put on the stock ticker than upon the business itself; the policy of the business often being determined, not by what would be the best for the industry, but by what would be best to " bull " or " bear " the stock market.

There are two distinct and separate propositions in the consolidation or so-called trust question. One is the stock or speculative side of the question; the other is the industry itself. Most of that which has been written has dealt with the first question, and next to nothing has been written as regards the effect of consolidated management on industry, and yet this is the all-important part of the question, for, let stock quotations fluctuate as they will, that which gives intrinsic value to, or takes value from, the securities of the company is the management of the industry.

We need to remember that the men who are the actual managers in productive industry, who are devoting their best energies to the development of machinery and men; who are giving their best thought to the development of efficiency in the working force and of intelligence in the managnent of the commercial side of business, are not as a general proposition, interested in speculative doings of the Wall Street manufacturers, whose finished product has been called "securities," if they can be designated by that name without doing violence to the truth.

The consolidation of industrials has made it possible to ascertain how business has been conducted by competing firms, and the methods, or lack of methods, of some have been a revelation.

It has been my pleasure to form the acquaintance of the managers of quite a number of consolidations in different industries, and the experience of one is the experience of all. In some of the companies consolidated they had never known the cost of manufacturing their goods; there had never been an intelligent attempt to learn the cost. The principle upon which they appear have acted was this: If one manufaturer quoted for an article a dollar, they knew they could make it for less than he, and so quoted ninety cents. There was an absolute lack of system in everything, save in one particular—their system of price cutting without regard to cost was perfect.

Consolidation also developed the fact that some plants were simply museums of antiquity, filled with machinery fit only for the scrap heap. Dead and dying concerns without money enough in the treasury to pay funeral expenses, and that is the only reason why they were still on earth, and the management, or rather, mis-management, might properly have been called "organized incompetence."

Permit me now to give you a chapter of ancient history. It is years behind us now so we can afford to laugh at it, but it was a mighty serious problem in 1898 when we were trying to see "where we were at."

When the company, of which I have been the general manager for almost ten years, was organized, our first business was to learn, if possible, what the costs of production were at the several constituent companies. Some of them could give us absolutely no data whatever, and if we had based our figures of cost on the information furnished us by some of them, we would have been in the hands of a receiver at the end of the first year. Some of the figures of cost furnished us were more than 100 per cent. out of the way, in other words, they could not manufacture their goods for more than twice what they claimed they

could. When the actual costs of manufacture (exclusive of paper which is our raw material) were finally determined, the fact was developed that the two companies which claimed the lowest cost of production, were the highest and were not entered in the same class with the other companies, and failure would have been the next step if the consolidation had not been brought about, but these firms made the prices at which some of the other manufacturers were forced to do business.

During the past ten years we have acted as undertaker and have cared for the remains of a number of companies, and we have had opportunities to acquire other companies, all of which has given us an opportunity to see behind the scenes and so learn how they did their business, and I would blush for the industry to put on record the ignorance developed. A firm doing business on the basis outlined is completely at the mercy of the unscrupulous buyer. There are a few such, we have all met them, and if some of us were to put on record some of their sayings and doings in the contest for highest honors, the late lamented ANANIAS would not receive even honorable mention.

One of the largest steadying qualities which consolidation will bring to industry will be the facts of business through a scientific system of accounting. The costs of production must be applied in industry by as correct a set of principles as are applied by the engineer in the construction of a bridge or building, and it is just as easy to work out a correct system that will definitely determine costs of production as it is to plan out the working parts of a machine, but this work must be done by an expert.

This is not the time or place to go into detail, but it is the time and place to make the suggestion, and I can conceive of no greater service which this organization can render to the industry with which you are all connected, than to have wrought out a scientific system of accounting by which the costs of production will be not only accurately determined, but properly apportioned on the product.

In those letters of the self-made merchant to his son, "Old Gorgan Graham," sets forth a good many homely truths, and

in one of his illustrations, comparing present conditions with those existing when he started in business, he says, "We all started in a mighty different world. We were all ignorant together and we didn't have to know fractions to figure our profits, but now to see profits you have to be well up in astronomy, and when with a powerful glass you do finally locate them, they are away out at the five point decimal place." Never were truer words spoken. This is the day when we think in large units, but there never was a time when the decimal counted for so much.

No man gifted with ordinary business sense, in building a house, would give the contract to a builder without first having had an architect prepare the plans and specifications by which the builder could intelligently work and on which to figure costs; nor would he turn over the construction of a machine to a force of mechanics, however efficient, without first having had the draftsman with great care and often at great cost, produce the working drawings. And yet, in the conduct of a great business where decimals are to determine whether there shall be a profit or loss, success or failure, the work of bookkeeping (it cannot be called accounting) is often in the care of clerks absolutely incompetent to give to the management any intelligent detail on which to base their judgment for the proper conduct of the business.

In general I believe it to be true that the mechanical departments of business are away ahead of the business management, looked at from the office end of the business. Business men learned years ago that to do work intelligently and economically in the mechanical departments, work must be standardized and systematized and to do this they used the best brains they could hire.

Accounting is not simply to make a record of what has been done, but it is to classify and tabulate the facts so that the management can intelligently decide what it is best to do for the future. More and more the accountant is to be a prime factor in the development of industrial efficiency. More and more

the management is to be guided and its actions determined by the facts developed through the accounting department. By analysis and comparison the accountant will develop a knowledge of the weak spots in the working organization, bringing them to the attention of the management. This department will be to the management what the mariner's compass and the sounding lead are to the captain and the pilot of the great ocean liner, without which the vessel with its precious cargo of lives and merchandise would be dashed upon the rocks.

An accounting system, to be of any value whatever, should be such that at the close of each period there can be made up a statement of the business in all its detail. It is not enough that the costs should go into a few general accounts; there must be an intelligent subdivision of every item of cost, whether of material or labor, and no accounting system is entitled to confidence which does not classify and properly locate every dollar which has passed through the books. Then if costs are increasing, the comparisons between corresponding periods, will reveal the fact, and if there are leaks they will be detected and stopped.

I have heard manufacturers refer to their bookkeeping and accounting as "unproductive labor," and in a true sense they made no mistake in calling it "unproductive labor," for it produced nothing by which to guide them in the conduct of their business. Accounting unproductive labor? It is the most productive labor in the whole establishment. Its finished product is knowledge born of facts, regarding costs,—not vague, indefinite, thumb-rule guesses.

The management of the large corporation, through the account system, is to do for industry what the inventor has done with machinery, for, after all, a machine is simply organized thought, and while no patents are granted for improvements in management, there are just as real inventions in the field of organization and management as in the field of mechanic arts, and it would almost seem as if a large part of the progress of the future, must come along that line, for in certain directions

it would seem as if machinery had almost reached the limit, and even though the machine were operated for nothing, the savings would be very slight.

Men have been willing to pay liberally for the highest grade of engineering skill if results could be produced; they have been willing to literally pour out money for new machinery and factory equipment, but it seems never even to have occurred to some of them that in addition to the new equipment of tools and the machinery in the factory, they needed brains in the office, and through this lack they have often been throwing away all the results obtained from a modern, up-to-date equipment and splendid management in the shop, and many a superintendent or manager of the manufacturing or mechanical department of a business has had failure charged to his account when failure should have been charged to the office.

Industrial accounting is being brought to a scientific basis; it is being systematized and standardized, but this work cannot be done by men lacking in the scientific knowledge of accounts and men must be willing to avail themselves of the services of the expert here exactly as they would in the legal, chemical or mechanical departments of their business. It is useless to equip a plant with every modern improvement and then through ignorance in the accounting department, throw away all the results of this modern equipment, and that is just what hundreds, yes, thousands of business men are doing today.

It is usually dangerous to prophesy, but you will permit me to quote from a lecture which I delivered at Dartmouth College in 1902.

"We have been having an era of prosperity such as this country has never before known. The output of our factories has been wonderfully increased, and sooner or later there must be a reaction. In the meantime several questions must for the time being remain unanswered. Will the stimulated production be permitted to glut the market? Will prices be forced down to a lower level to dispose of the surplus product?

"This has always been the experience of the past and these violent reactions have brought ruins to thousands. Just how the country will

meet these new conditions remains to be seen. Up to this time business men have had the experience of other depressions like those of 1873, 1884 and 1893 as a guide for future action, but the enormous consolidations of capital during the past few years have made entirely new conditions with which men have, as yet, had no experience which would qualify them to forecast the future. In a degree we face the unknown, and that is always difficult to face with wisdom and intelligence.

"The question will be, What will be the attitude of the large consolidation? In my opinion, it will in all probability, steady the market. It will not crowd production to such a point as to glut the market with goods and force stagnation that would paralyze industry and drive its competitors into bankruptcy, but it will not run short time to prevent excessive over-production while its competitors run full time; about that there will be no question. The consolidation is not going out of business; it will manufacture goods and sell them even though it may not be able to make much money.

When depression comes, in my opinion, the consolidations will take the lead in slowing down. If the competitors of the so-called trusts and consolidations are willing to do the same thing, adjustments will be made to fit the new conditions, but if they insist upon running full time, cutting prices to maintain their full product, that will produce a condition which will have to be met and while the consolidation will still steady the market, it may be forced to do it on so low a basis of profit, that it will be likely to produce a 'tired feeling' which the ordinary spring medicines will not entirely relieve and everyone connected with the industry, both 'insiders' and 'outsiders' will have to take the medicine."

Late in 1903 and in the early months of 1904 many lines of manufacturing industry passed through a period which bordered on depression. The word "depression" is a little too strong to accurately describe the conditions, and perhaps it would be better to call it a season of slackened activity. In a sense manufacturing industry slowed down and marked time but on the whole there was not much headway lost but the stock market or the speculative side of industry passed through a revolution early in 1904. Yet there was no panic in industry itself; on the contrary, through it all there was a steadiness which it has been hard for

me to account for except on the theory that it was the direct result of the influence of the large corporation which through all the fluctuations in Wall street, held a steady hand on the conduct of business and did not paralyze trade by demoralizing the market price of goods and by cutting down wages. The Wall street captain of industry might be gambling in the smoking room, but the real captain of industry was on the bridge and brought his craft safely through the storm.

We are now having a very serious depression and consolidated industry has done exactly what in 1902 I predicted it would do. We were facing the unknown conditions then suggested and the order was given to slow down and the competitors of the consolidations have, in the main, done the same thing and as a result, while we have had a smaller volume of business, we have practically had no panic in industry and the commercial highway has not been strewn with financial wrecks. Considering the conditions, we have had comparatively few commercial failures, nothing like what we would have had, in my opinion, without the steadying influence of consolidation.

So far as I can judge, business houses from one end of this country to the other, while not enjoying the abnormal volume of business which they had last year, all things considered, taking the country as a whole, are in a comparatively healthy financial condition. As a result of slowing down they have reduced their financial obligations, they have reduced their stock of made-up goods and they have taken an inventory and know their true financial condition. The working organization has not been destroyed by financial disaster. Stocks in the hands of the trade are very low; there is no glutted market such as has usually followed business depression and a comparatively small demand will set the wheels in motion.

We have simply been going too fast and as a railroad man would say, "Some were running past the danger signals set against them." They were going so fast they could not see the danger signals.

We have been and we are now somewhat in the position of

the captain of the great ocean liner in a fog, who has signalled the engineer to go slow. The line of business with which I am connected (the envelope industry) is one that acts as a barometer which pretty accurately registers trade conditions, and, gentlemen, I believe the fog is lifting. We have a good boat under us; we still have the sounding lead and compass and the stars and we shall soon be able to see the sun and take an observation and pick up the buoy which marks the channel of industrial progress and then the signal will be given "Full steam ahead".

Permit me now to illustrate how the consolidated corporation acts as a steadying power on the market. The price list established by the consolidation is not guessed at by the rule of the thumb. It is wrought out on a scientific basis of accounting and that price list is the basis upon which, not only the consolidation but practically every one of it competitors, does business. Not that all the competitors of the consolidation always adhere strictly to either the established prices or standards for quality, but the price list established by the consolidation is the base from which they make all their calculations. And this is true even where the consolidations control a relatively small percentage of the product.

I believe I am perfectly safe in saying in not one single industry does the large corporation control the market. It maintains at great cost a system by which its costs of production are very accurately determined and when a new price list is issued every competitor will practically duplicate that list within forty-eight hours or just as soon as they can get it through the printing office. They are not called upon to exercise a particle of judgment and they don't; they simply follow copy and they follow it so accurately that if there should happen to be a blunder in the list they will duplicate the blunder. From the fact that all manufacturers in a given industry issue practically the same list, many persons labor under the mistaken notion that there is an agreement or understanding between them and that the public is being held up, but such is not the case.

Now suppose there were no large corporation to establish a

price list or base line. Suppose that not only all of the competitors of the so-called trusts or consolidations, and also each of the constituent companies which form the consolidation, were making their own prices, with absolutely nothing to guide them except the very imperfect data which some of them formerly kept. I have not a particle of hesitation in saying that in my opinion, in the next three years half of them would go out of business, and that is just what would have happened in 1898–99 with thousands of manufacturing companies if consolidation had not saved them.

There were thousands of manufacturing plants taken into consolidations which were thus saved from bankruptcy, and the business then being put upon an intelligent basis, thousands of other plants which were not taken into the consolidations, were given a new lease of life, — new conditions being created which made it possible for them to live.

That is the steadying power of the large corporation and the independent manufacturer shares in the gain of this stability which the consolidation creates, and some of the competitors of the large corporation who talk loudest about fighting "the octopus" are in business today simply because the large corporation uses brains in the conduct of its business, and thus the ignorant manufacturer, following the lead of the larger corporation, is saved from himself.

I could name, in my own business today (and they can be named in every business), a half-dozen men who, without the steadying influence of consolidation to control them under such business conditions as have obtained for the past six months, would, at the first sign of that depression, have demoralized the industry by cutting prices, standards for quality and wages. These conditions, duplicated in all lines of industry, would have produced a panic, the result of which would have been financial ruin for thousands.

The United States Steel and other consolidations which might be named, stand, and from the beginning, have stood for stable prices and market conditions. During this period of prosperity

which we have been having, they could have forced prices up beyond all reason, but consolidations intelligently managed, did nothing of the kind and that is what would have been done without the steady influence of consolidation. They have exerted a steady influence against excessive advances, not from philanthropic motives, but because it was good business.

Now, on the other hand, when the time arrives that prices ought to be reduced the consolidation will exercise a steady influence against violent and extreme reductions so that the adjustment to meet new conditions will not be a rout but an intelligent and well-ordered retreat.

Now permit me to suggest how the large corporation acts as a steadying power in the intersts of the workingman. The fact has been developed that in almost every consolidation the firms or corporations consolidated were successful prior to the consolidation just in proportion as they adhered to a fixed standard for their goods, giving to their trade exactly what they agreed to give. In other words, the firms which made the best goods, who did business with a 36 inch yard and a 16 ounce pound had the most satisfactory trade, paid their help the highest wages and made the most money; and those who made the poorest goods paid their help the lowest wages and made the least money.

The poorest goods always have to meet the hardest competition. The same economic law is in operation here that operates on the untrained and inefficient workman who has to meet the competition of the crowd. The fact is abundantly proved that firms and corporations managed without intelligence invariably pay the lowest wages, and there is a reason for it which is not hard to discover. They produce the poorest goods; their product is usually sold at cut prices, often without regard to cost, for more often than otherwise they do not know what their costs are.

The business being conducted without system, at the close of the year may have shown a loss, or at least did not show the margin of profit expected. The management cannot see their way clear to advance their prices:—that is the last thing a cor-

poration conducted on the basis suggested considers. But the cost must be reduced,—where and how? Then begins a species of hap-hazzard figuring on very incomplete data. Where can savings be effected? Some costs are definitely fixed; those cannot be changed. Interest, insurance, rent, power, heat, light and taxes must be paid. There is no opportunity to scale those down. Towering high above all these items of cost combined stands the pay roll. A cut of 10 per cent here means a profit of $20,000 or $50,000. The cut in wages is made and the workman in the shop pays the deficit created by the lack of proper system and accounting intelligence in the office, and they start out to carry on for another season the same abominable business methods and force other manufacturers, who know the cost of their goods and who want to pay good wages, to cut down their operatives in order to meet that kind of competition.

Consolidation managers are not guessing,—they know that the lowest cost labor almost invariably produces the highest unit of cost of production, and I have no hesitation whatever in saying that no consolidation that has ever yet been organized, has tried or even thought of, reducing the wages of its workmen to the level of the poorest paid. The burden of consolidation management is to bring the efficiency of the poorer branches or divisions up to the level of the more efficient and with that higher degrees of efficiency there goes a corresponding increase in wages.

Character is a child of slow growth, and in our thought we give to the word "character" a narrow and contracted meaning, applying it generally only to man, but we must broaden our conception of what that word stands for, and apply it in the years to come to that creation of modern industrial conditions, which unthinking men are wont to call "*the soulless corporation.*" If it is to stand, and I believe it is, it must, maintain a *reputation* which has for its foundation, *character.* The consolidated corporation starts with a severe handicap; it labors under suspicion, it has an unsavory reputation, and in the mind of the general public it has no *reputation* whatever. This is largely on account of the doings of the promoter and those who, with him, worked a gold

brick bunco game, which in some cases would have made a vender of green goods on the Bowery blush, by unloading upon the consolidated company dead and dying concerns, some of which were acquired on a basis away beyond their actual value or their earning capacity. How often we hear the expression, "the soulless corporation," and too often it has deserved to be called "soulless," but the individual in the conduct of his private business can be and often is more arbitrary, dictatorial and dishonest than the so-called "soulless corporation." The burden of the coming years will be to give to these great aggregations of capital which are to be the mighty servants of mankind, a *soul*, inspired with righteousness and a spirit of divine service.

The Captains of Industry of the future who are to control these great corporations, must have more than simply leadership of organization. They must also have a leadership of ideals; they must learn the great principles of business and to that word "principles" must be given its largest and best meaning. They will not reach the highest rungs of the ladder by short cuts in climbing; it will be one rung at a time,—up, up into the clearer air, where, if a man will keep his hands clean and his head clear, he will have an ever widening horizon, and as he climbs higher he must remember that more people can see him and his acts must bear the scrutiny of the crowd. We have had some captains of industry to whose record we do not point with pride.

In those strenuous days a man should not make the mistake of making business the whole aim in life; he should not measure everything by the standard of the dollar. He ought to remember that "life consisteth not in the abundance of *things* which a man possesseth" and that a man's true value consists, not in what he *has* but in what he *is*. He ought to remember that the man who reaches the end of life with only money is poor indeed, and in the getting of which he can part company with all his friendships which are the finest assets of life. He ought to remember that "unto him to whom much is given, of him much will be required." Too often in our thoughts we limit that quotation to mean money,

but in the years to come I am persuaded that it will be given its larger and truer meaning,—that of service, and may we, whose privilege it is to command a large or a small unit in the great industrial army on the firing line of advance, inside the zone of fire and smoke, where the atmosphere is not always clear and where personal interests sometimes obscure real conditions, may we see our duty plain and be able to say in the language of the great Apostle Paul, before Agrippa, "I was not disobedient to the heavenly vision."

The PRESIDENT. We have time for one more paper before the hour of closing. The next paper will be read by a gentleman who is not only a noted woolen manufacturer, the proprietor of the Weybosset Mills, but also is well known as the industrial historian of New England, a profound scholar. I have the pleasure of introducing Mr. WILLIAM B. WEEDEN of Providence, R. I. [Applause].

THE ARTS OF WEAVING AND SPINNING.

WILLIAM B. WEEDEN, Providence, R. I.

Weaving and its daughter spinning, are such ancient and universal arts that, it is necessary to go beyond historic records and study them in the oldest monuments. Even now, or within a generation, processes of weaving practiced in old Egypt, or which clothed the pre-Columbian man, are or were commonly used in Africa and in the far-off isles of the Pacific.

Weaving does not depend on threads or spun filaments. To comprehend this homely process, we must go back to the centuries before Columbus and the Spaniards saw the Americas, and in the elder world, investigate thousands of years before Moses was launched in bulrushes on the Nile. Before spinning or a thread was conceived of, weaving began by interlacing rushes, stems, split canes and vines, strips of elm bark, palm and other fibres. It is customary among archæologists to classify prehistoric weaving into 1, wattle work; 2, basketry; 3, mattings; 4, pliable fabrics or cloths. Wattling was very primitive, sewing in the early fish wiers and in other stiff and heavy textures. Plain "twined-weaving" is considered to be a refined sort of wattling. Nothing of the textile sort was more important to the American aborigines, and by inference to any prehistoric barbarians, who lived thousands of years earlier—than basketry. Any supple fibre was deftly woven into a great variety of self-containing forms; baskets proper, hampers, cradles, shields, quivers, seives were useful in primitive life; matting soon followed for seats, carpeting, hangings, coverings and wrappings. Mats were used also for temporary shelters

and rude houses. Pliable fabrics or cloths appear in later stages of development. Strands led to spun threads. The North Americans — and their experience was comparatively late in prehistoric time — in using rushes, grass, etc., doubled smaller strands for uniformity. The New Caledonians quite lately made beautiful girdles from fibres of banana stalk, which were rolled and dried. The Hill Dyak women wore in modern times a "saladan" made of split bamboo and fitting closely to the body. There were fabrics of fibres, manipulated without spinning, in the South Seas, which were said to rival in softness the shawls of Cashmere. The Ainos, one of the elder races of Japan, were making in 1890 beautiful Ohiyo cloth from fibrous bark, generally of the wych-elm, occasionally of the common elm, on a horizontal warp pegged out on the ground. The inner bark was soaked and softened in water, then split into long, slender strands. The strands, tied without drawing or twisting, were wound into balls.

Primitive man, emerging from a world that was indifferent to his daily comfort, if not hostile to his existence; was immediately lifted up by these practices and stimulated mentally by this growth in the arts we have described. Furs might protect him from the cold of severe climates, but the elder man probably subsisted in a favoring atmosphere. The actual need of clothing was not the only motive in inventing fabrics. As suggested in basketry, his weapons were hardly more useful than the numerous contrivances furnished to his ready and skilful hand by the art of weaving.

We forget how slow, fragmentary and eccentric has been the progress of civilization. All the phases of weaving developed by the primitive loom, as above indicated, are or have been recently employed in the actual, industrial life of our present world. If we leave the process of analogy and turn to the investigation of history proper, abundant material exists for tracing the weaver along thousands of years of progress. There is ample documentary proof of the gradual introduction of the processes we have sketched, though we may not follow the

strict order of time. Perhaps the most satisfactory and complete record of textile manufacture is to be found in the scenes depicted on the tomb of BENI HASSAN in Egypt, now some 4,000 years old. These scenes are rendered in outline by WILKINSON in his ancient Egyptians. Many generations of cloth makers must have worked in the ways we have roughly indicated, before such a manufactory as this could have been conducted or even conceived.

Remember, this is a manufactory spread before us in these pictures, which render a typical account of actual industries. Two women are weaving at an upright loom; on another plate the more primitive weaving on à horizontal warp pegged out is represented. To return to the organized factory, three women are standing to spin. One woman sitting, is hackling or carding fibres, with a small instrument. Some are doubling and twisting single threads, and one male is apparently an overseer. The Egyptians exported linen fabrics largely throughout the Mediterranean, and labor to produce them must have been carefully organized, as is indicated here.

Distaff and spindle are now established in such an organization to rank equally with the loom. The primitive weaver was generally a male and the spinner a female, though this division of labor was not absolute. The hand that wielded sword or shield or the hunting spear, seldom bent to the task of spinning. Nimble feminine fingers were better adapted to this patient labor; and the processes of hackling, carding, combing and spinning were usually feminine and domestic.

As has been stated, weaving was in operation in the dim prehistoric light of faraway time, before the weavers could conceive of spinning. Primitive man in the struggle for existence had not time for spinning; nay more, he had not the mental development needed to draw a possible thread from a mass of tangle fibres. Our inventors, environed by motive power, with libraries recording mechanical agencies, work easily in comparison with those who toiled to change primitive ways. The reference to the soft, pliable garments lately made from banana, palm

and other fibres, to be worn by the islanders of the South Seas and elsewhere, was not casual but significant. These comforts antedated woollens, linens and cottons, while they stimulated and unfolded latent powers in the human mind, which crude nature could not satisfy. If a long fibre ready to the hand, was so convenient, why should not man combine the many fibres of wool or flax and sometimes cotton, to make a continuous thread of his own.

The Greeks took over Egyptian and Babylonian culture, and they amply symbolize the dignity of spinning. PALLAS was the especial patroness of all the arts connected with it. Spinning embodied some of the deepest and most mystic relations of man and nature — as conceived by the men of that time — for the fates spun out the thread of man's destiny, even as woman chew out the filaments of his garment.

The distaff in the left hand carried the carded fibres. The spindle, a stick about a foot long, cleft at the top, with whorl at bottom, dropped to the right hand. The graceful Grecian lady drew out the thread, twisting it with thumb and finger; then she detached it from the cleft and wound it on the spindle. Our automatic mules of today accomplish results similar to those reached by the Egyptian and Grecian spinners.

We can trace yet more rudimentary processes. For the Indians of New York and Pennsylvania, having no distaff, rolled the fibers of wild hemp on their naked thighs. The Cherokees had gone one step farther; for they hacked the hemp, and the old women spun it with a distaff.

The upright loom of the Egyptians and Greeks was much more developed than the early forms of primitive weaving. At first the warp was pegged out on the ground, while a rope around the sitting weaver kept the tension, or sometimes there was a roller beam before him. Icelanders, East Indians, the Ainos of Yezzo, the Japanese, the Solomon Islanders, weave today, or wove recently in this simple manner. The East Indian often dug a hole in the ground to accomodate his legs.

This simple process of weaving brought in the use of a loom—

early in development if not in time — which was brought from West Africa in 1867, by DU CHAILLU, and is shown in his book, " Ashango Land."

The Ishogo people of this region were famed for their *bongos*, woven from the delicate and firm cuticle of palm leaflets, skilfully stripped and divided by hand. There was no drawing or spinning. The men made needles and stitched the *bongos* into robes elegant in design, the threads being dyed for stripes and checks. There were four or five looms in a house or rudimentary factory, where the weavers sat at work, smoking and chatting cheerily, throwing the shuttle with the right hand and holding two " rods " in the left.

This sort of loom has been well-nigh universal. The Caribs, Samoans, New Caledonians, Javans, Japanese, East Indians, Mandingoes are recorded as using it, and the Aryans must have passed through these stages of weaving on their way to processes established by the Egyptians and Greeks.

The Navaho Indians wove blankets before their contact with Coronado's Spaniards. The warp was suspended between the posts several feet apart, or better between two trees. The shed was kept open by a rod, somewhat as the African Ishogo managed it. There was a sort of looping of the warp, by pushing balls of yarn between first and third threads. There was no shuttle. There was a batten and a reedfort, with some six or eight sharp, thin, wooden tines, then by fulling, a firm blanket was finished.

Complex machines have not made fabrics more perfect, for the finest textiles known were spun and woven by hand. Of these were the rare muslins of ancient Dacca. One when wet on the grass was invisible, hence *Shabane*, " the due of evening." Another, *ab rawan* or running water, could not be seen when immersed in water. We must remember that Jacquard only put into automatic action the " motions " which the weaver and his attendant " drawboy " had practiced for centuries. Some of the Japanese textiles, woven on the drawboy loom, are superior in texture and design to any existing in our present world.

Weaving was and is the interlacing of threads by crossing a woof, weft or filling through a warp stretching lengthwise. The present definition divides it into six branches, namely; plain texture, tweeling or twilling, double cloth, spotting, flushing, and crossed warps. "All the diversity of which these fundamental branches are susceptible arises from the mode in which the threads of warp are separated, or the sheds opened to receive the woof." When the shuttle is thrown across, the threads must be opened and partly lifted in a shed to receive the woof.

In all weaving there are two vital movements of the woof; the shooting across of the shuttle and the driving home by the modern lay, which makes the fabric firm and strong. The Ishogo man weaving his *bongos* moved his rod with his left hand; the Icelander at about the same period 1867, and the Greek some eighteen centuries earlier, beat either upward or downward with the *spatha* or wooden sword. Similar operations may be traced as civilization went north and westward through Europe. The Vikings had an ancient loom from the Faroes, upright with the warp weighted below. The Irish had spinning and weaving in all the homes of the peasantry. After the warp was laid horizontal and the shed was sprung with treadles, the rod having been developed into a comb or reed. was fitted into a swing frame called the lay. Probably this frame somewhat facilitated the thrust of the shuttle. But the mediæval loom improved very slowly. The hand loom of the seventeenth and early eighteenth centuries was brought to New England by the English, and by the Spaniards to their colonies. A remarkable survival of the unfit mediæval loom was in a district of South Wales. It was used there in 1890 by descendants of the Flemings imported into England by EDWARD III.

An exceedingly interesting bit of weaving is brought over by STUBEL and others, from the progressive industries of Arica, Peru. Historically it is pre-Columbian, and in evolution it ranks with that certain development of the hand loom we have shown in many places as civilization advanced. The pocket

wallet and sabretasche have been important in weaving apparel. The original of this pocket was 22 centimeters long by 24.5 wide. Wholly of wool, the woof is of dark red and the warp carries five colors — red, white, black, violet and brown. Two layers of warp or double cloth weaving give much effect to the varied colors of the woof. The simple basket weaving of the upper layer appears richer by a contrast with the woof colors. The pattern is very complicated to the eye, and must have been harmonious in color while the mechanical weaving is not difficult. This example is a type of the weaver's efforts, as the time demanded richer and more æsthetic effects in various fabrics. There are fine specimens of early Peruvian fabrics at the Peabody Museum and in the Museum of Natural History at New York. Some Poncho shirts or tunics of vicuna wool in the warp and twisted cotton threads in the woof are admirable fabrics. The threads are fine and evenly spun. The designs are very ingenious and spirited. Rude forms of birds and the human figure are clearly portrayed.

There was no substantial improvement in the process of manufacture, so slowly developed in the hand loom, until the great eighteenth century had started mankind into new industrial life. KAY added a shuttle-box and driving picker-stick — which sped the flying shuttle through the swing-frame — in 1733–1750. This woof-motion quadrupled the product of a single weaver, and it made possible the power looms of CARTWRIGHT in 1786. All the processes we have described became automatic; for the warp and woof moved themselves, so long as the loom went right. But there are immense numbers of hand looms working today in Japan, China and India. Peasant houses in Russia have the old loom. In 1901 the provinces of Vladinur and Moscow alone had more than 10,000 peasants weaving silk by hand, and a far greater number at work on fabrics of cotton, linen and wool. In 1901 Japan had 32,000 power looms weaving cotton goods, at the same time she operated 708,000 looms by hand.

Coming a little latter than CARTWRIGHT, the Englishman, the

French JACQUARD in the spirit of the same creative time made the drawboy loom automatic. Both the original and its automatic offspring are among the most marvellous pieces of mechanism known to humanity; whether in Asia or Europe, China and Japan as well as India, made the most beautiful fabrics the world has ever seen on this loom, and by hand.

In plain texture a thread crosses its fellow forever, as it were, in the monotony of sheet, shirt, sail, bag, tent, and all the common fabrics. The drawboy or Jacquard made any thread the fellow of any and every thread, controlling it absolutely. He could make a monotonous basket or bring out the lineaments of the human face.

In the draw-loom the warp threads are passed through loops formed in strings — vertical — one string to each thread, with the strings in groups. The weaver is seated, throwing the shuttle as usual. From a frame above, the drawboy at the weaver's call, pulls the group strings, or in other words, lifts all the threads the pattern calls for. These groups are fixed by a design on paper held by the weaver. With "unerring precision" and the utmost "regularity" the drawboy pulls the cords which bring out the pattern as the shuttle passes under.

Did time allow, a volume might be made concerning the improvements in weaving in the United States during the nineteenth century. They culminate in the Northrop–Draper loom, a wonderful daughter of old Egypt.

Wherever we turn in literature we find the loom and the spinner, whether in the gravest records or in symbolic scenes, which betoken the life, whence the poet derived his culture.

The greatest heroine of all time is thus pictured;

> Here in the palace at her loom she found
> The golden web her own sad story crowned;
> The Trojan wars she weaved, herself the prize
> And the dire triumph of the fatal eyes.

Virgil in a Georgic of a later time gives some detail of the making of fabrics.

Ethiop's hoary trees, and wooly wood
Let others tell; and how the Seres spin
Their fleecy forests in a slender twine.

He alludes to cotton and the early notion of silk sericum, which was fabled to be a fleece from trees before the ways of the worm were known at Rome.

Wherever we touch progress and civilization, one principle holds. And it is, the prevailing humanness, so to speak, the universality of the arts of weaving and spinning, as they take hold of man in his development, whether that be simple or complex. Time is of no account in progress. Man is his own self-registering clock and dial plate. Anywhere above the lowest savage state, weaving or weaving combined with spinning is a well defined art, developed out of immediate wants, and constantly adapting itself to life; to living in new forms and controlled by new necessities. Machinery has done much for civilization, but the industrial system sacrifices while it creaks; it is not clear gain. We have improved the condition and stimulated the intelligence of the masses of mankind. Has quality of work improved in like proportion? The masses care most for many and cheap comforts; they do not appreciate much less demand, the few, the more artistic, the more enduring things. The world is better off than ever today; it will be yet better tomorrow.

At some time in the future, primitive man may be more highly appreciated than he is just now. Like tyros, we sport with the awful powers of nature by setting a portion of the great forces against such other forces, as for the moment we can comprehend. Yet it is only thought that animals matter, whether it be in the stroke of a stone hammer or in the lift of an electric crane balancing a hundred tons.

Our mother nature may be dreadful, but we know that she is beneficent, if wooed intelligently, constantly, and soothed into peaceful mood. In early development, myriad Adams and Eves went up and down the earth, struggling with spirits constantly — with demons occasionally. The man who first conceived the

lightning flash to be no capricious Jovine bolt, no demoniac freak, but a throb in the order of nature, was greater than EDISON.

We toil and sweat in the grime of machinery, we grow deaf in the chink of gold as it moves the wheels of finance. We putter with records. In time the seer will come and render forth in his own song the true meaning of mechanisms, of all this intercourse with nature, the actual story of these new exploits of man.

The PRESIDENT. The meeting now stands adjourned till two o'clock.

SECOND SESSION.

TUESDAY AFTERNOON, APRIL 16, 1908.

The Association met in Huntington Hall, at 2 P. M., President HARTSHORNE in the chair.

The PRESIDENT. The meeting will please come to order. The first paper on the programme will be the one which was omitted this morning on account of lack of time. The author is the Vice-President of the E. H. Jacobs Manufacturing Company, one well acquainted with the financial side of cotton manufacturing. We had great pleasure in listening to him in a very interesting paper on The Evolution of the Lug Strap, at the Washington meeting. I beg to introduce Mr. W. IRVING BULLARD of Danielson, Connecticut, whose subject is Cotton Mill Stocks as Investments.

Mr. W. IRVING BULLARD. *Mr. President, Gentlemen:* This paper which I am going to read to you I have been preparing for two years. Prior to my interest in the E. H. Jacobs Manufacturing Company I was connected with several financial publications, being at one time bond editor of The Wall Street Journal. At that time I saw the vast opportunity to say something about cotton mill stocks. This is the first opportunity I have had to say it since then.

COTTON MILL STOCKS AS INVESTMENTS.

W. Irving Bullard, Danielson, Conn.

Cotton mill stocks are attractive investments because of stability of market value, large dividend returns, liberal margin of earnings over dividends and high ratio of liquid assets to capital stock. The seasoned textile stocks compare favorably, from every market viewpoint, with the better class of railroad and industrial stocks, and in many cases, the book value and quick assets back of the "textile" place it in the same class with the stronger industrial and railroad bonds, without a limit on the investment return as in the latter securities. Cotton mill stocks are a first and only lien on an industry of great economic power producing one of the fundamental necessities of life, capable of limitless expansion and very much under capitalized. This is the only industry that has not been subjected to consolidations, trusts and combines, or had its stocks watered to the last degree.

In many states, cotton mill stocks are exempt from taxation, and return to the investor a very much greater income than could be secured from any other form of investment, with the same security of principal. These securities are inherently safe and while the dividend return may fluctuate from year to year, because of the extra dividends paid during periods of prosperity, the average annual dividend return will be vastly more than could be secured from any other form of conservative investment. Cotton mill stocks are conservative investments because of the ample margin of earnings over the dividend

requirements, the low capitalization as compared with replacement value, the conservative allowances for depreciation, the very large actual net assets which represent the security of the principal, and the highly efficient management characteristic of the cotton industry.

HISTORY OF THE INDUSTRY.

Nearly all of the older mill corporations started as partnerships or close corporations, but in the division of estates and sub-divisions, into the second and third generations, the necessity for a more diversified ownership was created, because many of the successions were either unqualified or incompetent to carry on the industry and then it became necessary for outside interests to take the management. Col. HENRY LEE of Boston once said, that it was three generations from shirt sleeves to shirt sleeves, and this has proven true a number of times. One of the largest Massachusetts cotton mills was formed as a close corporation, and, in three generations, there is but one stockholder who holds over $15,000.

There still remain relics of the former individual and family control and ownership of cotton mills. B. B. and R. KNIGHT control a large number of Rhode Island, Massachusetts and Connecticut cotton mills, the stock of which never comes upon the market and the earnings of which we never hear of. It is only a question of time before this form of ownership will be entirely abandoned and corporate control exercised. It only takes a generation or two to eliminate family ownership and close corporations in times of progress like the present.

The general public has no realization of the economic development of the textile industries during the past century. Cotton manufacturing differs from any other textile and in a greater degree from the fundamental industries, because of the relatively low ratio of the price of the raw material to that of the manufactured product. That is, the cost of labor forms a greater ratio of the cost of goods than any of the textiles. Therefore, engineering work, either as applied to the devolopment of

power, inventions of machines, and construction of mills, has necessarily been more vital than in any other fundamental industry. It has been conceded that the economies, both as to the character and quantity of the product of the cotton mills, have been expended to such an extent during the past few years that their aggregate, in the improvement of the cotton manufacturing industries as a solid fundamental industrial proposition, has not been appreciated by laymen, who have associated the prosperity or adversity of a particular mill stock as a result of fortunate or unfortunate times of the purchase of raw material and by the sale of finished goods.

The original motive power of the cotton industry, was human energy; then water power, which has been an exceedingly useful factor since the introduction of cotton manufacture. As mills grew, requiring more power, and in the cutting away of forests, reducing the summer flow, two causes attributed to the necessity of introducing steam power in connection with the water wheels. Then came the introduction of the more economical type of steam power with high pressure compound engines, which reduced the cost of steam power to such an extent that transportation rates on raw material and finished commodities loomed up as the important factor when considering the site for new factories.

The recent development in the electrical transmission of power has given a high value to water power, which would have been commercially worthless except in connection with existing mill properties. For this reason the values of undeveloped water powers have recently increased and become an important asset for the corporation owning them. I shall not attempt to trace the development of the motive power, but just consider, gentlemen, the tremendous reduction of the cost for energy per horse power fifty years ago, when the water-wheel was supplemented by steam power, and today when you can transmit energy from a number of water powers to a factory site most favorable from a transportation and manufacturing standpoint. I know of five generators representing energy from a group of

STATISTICS RELATIVE TO COTTON MILL STOCKS AS INVESTMENTS.

NAME OF COMPANY.	Date of Incorporation.	Capital.	Surplus.	Debt.	Earnings per Share, 1907.	Dividends 1907.	Total Dividends 8 years. (Per Cent.)	Average Dividends 8 years. (Per Cent.)	Book Surplus per Share.	Capitalization per Spindle.	Par Value.
Amoskeag,	1831	$5,760,000.	$3,720,691.	$1,425,000.	$21.30	$16.00	126	15.75	$64.59	$10.76	$100.
Androscoggin,	1860	1,000,000.	1,123,864.	16,559.	24.91	10.00	75	9.37	112.38	13.93	100.
Bates,	1852	1,200,000.	1,376,361.	117,565.	41.87	35.00	130	16.25	114.61	14.61	100.
Border City,	1880	1,000,000.	333,598.	500,000.	37.50	23.50	119	14.87	33.35	12.51	100.
Richard Borden,	1871	1,000,000.	502,174.	541.	32.62	20.00	*101	12.62	50.21	10.37	100.
King Philip,	1871	1,500,000.	851,765.	150,431.	25.65	6.00	168½	21.25	56.78	11.10	100.
Dartmouth,	1895	600,000.	685,105.	470,529.	82.50	66.00	158	19.75	114.18	5.00	100.
Dwight,	1841	1,200,000.	1,299,219.	735,740.	103.94	12.00	100	12.50	108.26	5.45	500.
Great Falls,	1823	1,500,000.	960,000.	338,603.	21.33	12.00	117	14.62	64.00	11.36	100.
Laurel Lake,	1881	600,000.	184,251.	None.	28.24	14.00	†190½	23.75	37.08	10.03	100.
Mass. Cotton,	1839	1,800,000.	1,431,690.	2,160,763.	41.30	5.00	50	6.25	79.53	14.13	100.
Lawrence,	1831	1,250,000.	787,000.	500,000.	25.27	8.00	122	15.25	62.96	12.50	100.
Pacific,	1853	3,000,000.	6,332,854.	None.	550.00	320.00	124	15.50	2,110.95	. . .	1,000.
Pepperell,	1899	2,556,000.	1,628,487.	117,940.	. . .	12.00	158	19.75	63.71	10.27	100.
Sagamore,	1879	900,000.	355,693.	607,899.	48.53	30.00	85	10.63	39.52	9.80	100.
Troy,	1814	300,000.	474,294.	2,816.	335.00	67.00	189	23.62	794.90	6.31	500.
Union,	1879	1,200,000.	584,044.	None.	46.00	35.50	183	22.87	48.67	10.89	100.
Whitman,	1895	1,500,000.	945,411.	474,245.	29.76	8.00	58½	7.25	63.02	11.35	100.

* In addition to which a 25 per cent. dividend was paid.
† " " " 100 " " " "

as many water powers, feeding into one general motor in the power house of a cotton mill situated near a railroad and miles from any of these water-falls.

EARNING CAPACITY.

The earning capacity of cotton mills is dependent primarily upon the general economic situation of this country, although our exports to the Orient are quite an item. In three years, we have shipped to China $53,000,000 as compared with England's export trade to China of $139,000,000. Trade returns show a world's market in 1907 for more than $500,000,000 worth of cotton cloth and our share of it reached the magnificent total of $15,000,000, while we supply less than one-third of one per cent. of the demand for cotton yarns. Not until we secure our share of the export trade will the cotton mills of our country show stable earnings. Our cycles of prosperity and depression are so frequent that they serve as a severe handicap from a manufacturing, commercial and financial standpoint, but if we could balance local economic reverses with prosperity in foreign countries and throw the balance of our production to export, we would then maintain an equilibrium of earnings.

The accompanying table illustrates very forcibly the earnings on both "print goods" and "fancy goods" mills. During the past year the cotton industry was more prosperous than in any previous year in the history of the cotton manufacture. "Plain goods" and "fancy goods" were alike in abnormal demand and earnings responded accordingly. Because of the broader market for plain goods, it does not necessarily indicate that stocks of "plain goods" mills are more desirable, for one must consider the average earnings for a period of years. There is no question but that greater dividends are being paid on "fancy goods" stocks than "prints", but the aggregate amount of dividends paid since the incorporation of a particular "print goods" mill will compare very favorably with the same figures of a "fancy goods" mill.

The cotton industry is a tremendous opportunity, and it is

within our power to develop this opportunity. It is on the threshold of the greatest economic development in the history of the country and, if we put our shoulders to the wheel, within twenty-five years we will be manufacturing the greater portion of our entire production of raw material and be supplying the world's markets with finished products.

We can do this because our machinery is as good as any in the textile world. We have the advantage of the cotton yield within our own boundries and there is reason to expect a greater efficiency of labor from our operatives by interesting them in the ownership of the industries, such as has already been accomplished very broadly in the manufacture of metals.

In short, as was stated by Mr. D. A. TOMPKINS at a meeting of this Association many years ago, "As long as a bale of American cotton is sent across the Atlantic, so long will there be opportunities for more American cotton mills."

DIVIDENDS PAID ON COTTON MILL STOCKS.

The liberal dividend policy of leading cotton mill corporations in New England should be the first consideration of the prospective investor. The tables accompanying this paper narrate very forcibly the dividend history of cotton mill stocks. During the past eight years, which period constitutes an economic cycle of our industrial welfare, such seasoned textile stocks as Bates, paid an average annual dividend of, $16\frac{1}{4}$ per cent., Dartmouth, $19\frac{3}{4}$ per cent.; Laurel Lake, $23\frac{3}{4}$ per cent.; Pepperell, $19\frac{3}{4}$ per cent.; Troy, $23\frac{5}{8}$ per cent.; and Union, $22\frac{9}{10}$ per cent.; and during this period have added a greater percentage to their surplus and working capital. A comparison of surplus earnings over the dividend requirements of ten cotton mill stocks with an equal number of high grade railroad bonds and industrial preferred stocks places the "textile" in an enviable position.

The tables which I have prepared prove that there is no class of investments paying as attractive dividends, earning so large a surplus and showing so great a book value per share as cotton mill stocks. The ten Fall River stocks, which I have used in one

of the tables, show larger dividends, greater earnings per share and less market value depreciation than ten of the better industrial preferred stocks that are held quite extensively in New England.

Last year, Boston & Maine showed a margin of safety of earnings over dividend requirements of 1.25 per cent.; St. Paul, 5.74 per cent.; Chicago & Northwestern, 6.26 per cent.; Delaware & Hudson, 6.93 per cent.,; Great Northern, 6.01 per cent.; Illinois Central, 4.60 per cent.; New York Central, 1.42 per cent., and Pennsylvania, 2.51 per cent., while an equal number of New England cotton mills, not including Fall River and New Bedford, showed a margin of safety of an average of 9½ per cent. Fall River earnings were much greater as shown by one of the tables.

To prove that cotton mill stocks have been large dividend payers over a period of years, I have prepared a table showing the dividends paid from the years 1839 to and including 1848 by a number of our leading New England cotton mills. While the legal rate of interest at that period in New England was six per cent., and in New York, seven per cent., textile mill stocks, paying an average of eight to ten per cent. annually, were selling at a discount.

THE NEW BEDFORD GROUP.

The aggregate amount paid by New Bedford cotton manufacturing corporations in dividends in 1907 was $2,489,750, or $1,110,250 more than was paid in 1906, an increase of 80½ per cent. The average dividend rate paid in 1907 on the capital stock of New Bedford's cotton mills, other than those which are new, was 15.18 per cent. For the past ten years, dividends have averaged as follows: Acushnet, 21 per cent.; Bristol, 3.17 per cent.; City, 10 per cent; Hathaway, 13 per cent; Pierce, $11\frac{9}{10}$ per cent.; Potomska, $5\frac{3}{10}$ per cent.; Wamsutta, 6.35 per cent.; Grinnell, 9.8 per cent. for seven years on a present capital of $1,000,000; Whitman, 7.4 per cent. for five years on its present capital of $1,500,000; Dartmouth, 18 per cent. since

HISTORICAL TABLE OF MILLS IN MASSACHUSETTS, 1839–1848.

MILLS.	Capitalization.	Par Value.	Market Price, 1848.	Per Cent. Dividends for Ten Years.										Av. Annual Dividend for 10 Years. (Per Cent.)
				1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	
Appleton,	$600,000.	$1,000.	$800.	5	3	12	12	6	6	. .	6	5	5	6.
Boott,	1,200,000.	1,000.	850.	5	8	16	16	10	5	3	11	4	11	9.10
Boston,	450,000.	†750.	650.	4	6	10	5	8	3	. .	6	3	6	5.10
Dwight,	730,000.	1,000.	800.	6	9	16	20	18	11	3	X	X	X	11.85
Great Falls,	1,500,000.	200.	185.	8	10	12	*12	17	3	5	9	. .	. .	7.60
Massachusetts,	1,800,000.	1,000.	900.	6	19	20	20	14	4	3	. .	X	X	10.07
Otis,	450,000.	1,000.	1,050.	6	13	8	12	10	10	. .	. .	. .	. .	5.90
Thorndike,	600,000.	1,000.	875.	3	7	15	15	14	5	3	11	. .	. .	7.30
Tremont,	600,000.	1,000.	875.	2	7	16	18	16	26	8	7	1	1	10.20
York,	1,200,000.	1,000.	930.	6	11	20	18	27	6	7	9	12	12	12.80
Average annual dividend from above mills,				5.10	9.30	14.50	15	14	7.90	3.20	6.55	3.12	4.37	

* Stock dividend of 25 per cent.
† Par reduced from $1,000. All dividends given are on a par of $1,000.
X Not in operation.

During the period represented by the above table, the total amount of capital invested in cotton manufacturing in this country was $65,000,000.00, the annual value of manufactured products $47,000,000.00, and the number of spindles, 2,300,000.

1899, when it began paying dividends. New Bedford ranks first in the United States in the manufacture of fine cotton goods and fine yarns, and ranks second in the number of spindles in its cotton manufactories. All of the New Bedford mills are in a strong financial condition, equipped with the most modern machinery and are conservatively managed. Their securities are widely distributed in New England and can be easily sold.

FALL RIVER GROUP.

Fall River, the largest cotton manufacturing centre in this country, has more than one-seventh of all the spindles in the country, one quarter of those in New England and manufactures more than three-fourths of all the print cloths. In fifty years, spindles in Fall River have increased from 250,000 to nearly 3,500,000, with an aggregate capitalization of approximately $26,500,000. The accompanying tables show the average dividend rate for a number of the more prominent mills for the past eight years, and give interesting statistics regarding price fluctuations and earnings per share during the past year, which was one of the most prosperous in the history of the industry in that city. I criticise the present system of Fall River cotton mills declaring extra dividends from excessive earnings, which makes the dividend return fluctuate widely. Instead of paying twenty per cent. one year and five per cent. the next, there would be a greater stability to the securities, and it would be an act of financial prudence, to declare, say ten per cent. for each year and carry the balance to surplus. Spasmodic dividend paying and bonuses are not justifiable nor consistent with modern financiering. Fall River stocks are not as widely distributed as they should be because of this one fact, which could be easily corrected.

The advantages of a large working capital are self evident, but if a certain piece of legislation proposed, becomes enacted, the working capital of cotton mills located in New Bedford and Fall River will have to be materially increased, either by conservation of earnings or by the issuance of new capital stock.

This proposed legislation prohibits Massachusetts savings banks from accepting three name paper to an amount exceeding $2,500, unless it be protected by collateral. If mutual savings banks are restricted to this extent, mills will suffer severely. Such loans have played an important part in making Massachusetts the leading textile centre of the Union, and if they are prohibited, it will be little short of a calamity to textile mills. In New Bedford and Fall River, the amount of funds loaned on three name paper by savings banks is about equal in aggregate to the total amount of loans on discounted paper by Boston National Banks and Trust Companies. I feel confident, that the more conservative banking interests in this state will not permit the enactment of this restriction.

SOUTHERN COTTON MILLS.

Not until after the Civil War were the necessary economic conditions created in the Southern states that would allow the establishing of cotton mills. When the economic progress, which had been throttled for a period of years, again became a fact, cotton spinning and weaving were introduced in the Carolinas. The initial labor force was furnished by the natives of the mountains in Kentucky and Tennessee, who were more or less familiar with hand weaving. Then the families of the small farms and the better class of colored help, were educated to the requirements of the industry. Plain goods and the cheaper grades of fancies predominate in the South, although there has been quite a general introduction of the finer counts during the past few years.

Southern cotton mills that have paid dividends for the past ten years, with a very few exceptions, have declared comparatively small profits. More at an average of six per cent. annually and under than over, with no extra disbursements to the stockholders from surplus profit, while during the same period in the North, extra dividends have been chronic. I am familiar with negotiations that were pending in 1901 and 1902, for the consolidation of about fifty weaving and spinning mills in North

COMPARISON OF INDUSTRIAL PREFERRED STOCKS AND FALL RIVER COTTON MILL STOCKS.

TITLE OF COMPANY.	Annual Dividend, 1907.	Earnings Per Share. (Per Cent.)	1907. High.	1907. Low.	Per Cent. Market Value Depreciation.	NAME OF STOCK.	Dividend Paid 1907. (Per Cent.)	Earnings Per Share. (Per Cent.)	1907. High.	1907. Low.	Per Cent. Market Value Depreciation.
Central Leather,	7	7+	102	68	33.33	Ancona,	*12	111	100	97½	2.50
Chic. Jct. Railway,	6	19	120	99¾	16.10	Cornell,	16	30	150	150	. .
Corn Products,	7	14	88	46	47.72	Chase,	†6½	30	130	115	11.53
Fed. Mining,	7	22	97	37	61.85	Flint,	12	26	115	97½	15.20
General Chemical,	6	. .	102½	85	17.15	Laurel Lake,	‡14	28	130	110	15.40
Ry. Steel Spring,	7	16	100	50½	50	Merchants,	§5¾	36	145	83¾	42.20
U. S. C. I.P. & Fdy.	7	14	89	49	44.90	Mechanics,	7	23	111	80	28
U. S. Reduction,	6	6+	68	18¼	73.16	Sagamore,	30	48	175	140	20
U. S. Rubber,	8	15	109⅞	61¼	44.25	Stafford,	5½	30	104	100	4
U. S. Steel,	7	24	107¾	79⅛	26.57	Wampanoag,	4	33	98	70	28.57

* Dividend and earnings on Preferred Stock.
† Stock dividend of 33⅓ per cent. also paid.
‡ " " " 100 " " "
§ " " " 50 " " "

Carolina, South Carolina and Georgia, with a capitalization of $60,000,000 or slightly in excess of $20.00 per spindle. The object of this consolidation was to provide about $10,000,000 of northern money for working capital, which would have placed these fifty odd mills on a sound financial basis, and eliminated, to a large extent, large commissions being paid New York commission houses for the sale of their products and for the advancement of funds. The industrial reaction in 1903 prevented the completion of negotiations. This is the nearest approach to a cotton manufacturing trust that has ever been contemplated in the South. Southern mills, as a whole, are well managed, equipped with modern machinery and have many known advantages over northern plants. Their securities are more closely held than northern cotton mill stocks and the market for them is quite narrow, but the first suggestion of the approach of an era of extra dividends and stock bonuses will broaden the market materially.

ENGLISH COTTON MILL STOCKS.

Since cotton spinning is the more important department of cotton manufacture in England, I have confined my search for data regarding the investment value of English cotton mill stocks to spinning corporations. Dividend disbursements and surplus earnings reached a new high record in 1907. The average dividend disbursement for 100 mills in the Oldham district was 15⅞ per cent., while the actual net earnings showed an average of 35½ per cent., or an 18 per cent. increase over the net earnings for 1906. These figures are from mills that make public returns of their financial operations, while the net earnings of 80 corporations that do not disclose trade profits, reveal an average dividend of 17⅞ per cent. These dividend disbursements do not represent the actual percentage paid on the capital stock, because English cotton mill financiers issue stock of a given par value, say $25, and then call for payments in instalments as the funds are required, and dividends declared

are on the actual amount paid in, and not on the par value of the securities.

Here is an illustration of English cotton mill financiering:

A few operatives or managers in a cotton manufacturing community, having saved $5,000 to $10,000 each, form a limited company or corporation, with a par value of $25 per share of stock. Mill builders, machinery manufacturers, architects, oil merchants, belt manufacturers, etc., are solicited to subscribe for as many shares of capital stock as the order for their particular line would amount to. The first assessment or instalment to the amount of $5 to $12.50 is called for as the work progresses, which amount, with the original subscriptions from the promoters, is generally sufficient to pay for the buildings and equipment. Then the item called "Loan Capital" becomes operative. Call loans are secured from individuals and banking institutions, at from four to five per cent. interest, and used for the working capital. All earnings, after the payment of operating expenses and interest on the "Loan Capital" are applicable to dividends on the actual amount paid in and not on the entire capital stock; hence, a dividend of ten per cent. would not indicate very large earnings per share of capital stock.

When trade becomes dull and the "loan holders," as they are called, become uneasy over the situation, they demand their loans and the mill is obliged to call upon the stockholders for instalments sufficient to cover the funds withdrawn, but only up to the par value of the stock. The next dividend on the same earnings would be considerably reduced; that is to say, there is a sliding scale of dividend returns depending upon the ratio of "Loan Capital" to instalments paid in on capital stock.

At Oldham and Manchester, England, there are public auctions daily for the sale of cotton mill stocks which command a fairly broad market. During the past three months cotton manufacturing and spinning in England has been about as unsatisfactory as in this country, and cotton mill shares have declined in market value from twenty-five to fifty per cent. because of enforced liquidation.

TABLE OF ENGLISH MILLS.

MILLS.	Capital.	Par Value.	Amount Paid In.	Current Loans	Per Cent. Dividends. 1907	Per Cent. Dividends. 1906	Per Cent. Earnings, 1907.	Spindles.	Quotations, Mar. 4, 1908.
Coldhurst,	$375,000	$25.	$12.50	$54,770.	10	10	25	61,380	$11.00
Crawford,	700,000	25.	10.00	77,755.	10	10	43	167,424	14.00
Equitable,	323,125	25.	25.00	6,275.	8	8	21	87,692	13.75
Guide Bridge,	750,000	25.	12.50	199,646.	10	10	32	156,864	10.25
Mitchell Hey,	329,275	25.	25.00	113,790.	12½	20	20	60,312	25.00
Newton Moor,	452,250	25.	25.00	99,265.	7	7	14	12,258	10.75
United,	500,000	25.	15.00	112,665.	10	10	24	107,188	9.75
West End,	375,000	25.	25.00	173,655.	10	10	28	131,996	24.50

SUMMARY OF ONE HUNDRED MILLS IN THE OLDHAM DISTRICT.

Capital employed, $30,501,230.00; net earnings, 1907, $6,605,785.00; average earnings per mill, 1907, $66,055.00; average earnings per mill, 1906, $32,775.00; average dividend, 1907, 15⅞ per cent.; average dividend, 1906, 9⅔ per cent; spindles, 8,592,788.

SECURITY OF COTTON MILL STOCKS.

In determining the security of cotton mill stocks, one of the most important factors is the net quick assets, which are not easily determined on account of the present system of making financial statements, but as a rule, in the more conservatively managed, the net quick assets represent about the capitalization. The Bates net quick assets are $200,000 in excess of capitalization; Dwight has quick assets of $1,499,221, as compared with a capitalization of $1,200,000; Pacific has net quick assets of $8,832,000, and a capitalization of $3,000,000; Great Falls net quick assets of $1,460,605, and a capitalization of $1,500,000. In brief, there is dollar for dollar back of every share of capital stock of our prosperous cotton mills, and a far greater percentage of assets than of many railroad and industrial stocks and bonds. Cotton mill stocks are entitled to a place in the lists of savings banks investments, because of their security, and it will not be many years before there is legislation permitting the investment of savings bank and trust funds in seasoned textile mill stocks.

REPLACEMENT VALUES.

It will be seen from one of the accompanying tables that nearly all of our cotton mills are capitalized for a great deal less than the replacement value, notwithstanding their machinery is at a high point of efficiency. It is generally conceded that $17.00 to $18.00 is a fair spindle cost for building a print goods mill today; $22.00 for a fine goods mill, and $25.00 and upwards per spindle for a colored goods mill, and so from these figures one can easily see that the cotton mills are not over capitalized, but on the other hand, are under capitalized. I doubt if any of us would care to duplicate the Pepperell at $10.27 a spindle, the Acushnet at $4.00 per spindle, or the Pacific at $16.67 per spindle, including the woolen department.

DEPRECIATION.

The subject of depreciation has a very important bearing on the value of cotton mill stocks. When EDWARD ATKINSON, the

well known economist, was assistant treasurer of a Lewiston, Me. cotton mill, a large stockholder, noting some changes in a new mill, said, "Can't you finish one end of a mill before the other is out of date?" That is just the condition of the cotton manufacturing industry! Improvements in machinery have been so constant, the inventive genius so progressive, during the past decade, that constant changes in the manufacturing map of the cotton industry have been necessary. Many of our larger mills could provide for these changes from surplus earnings during prosperous years, while others, which were manufacturing goods on a closer margin, were obliged to make liberal annual allowances for such improvements.

More business men are ruined by their own bookkeeping than by incompeteney or losses in trade, and the question of depreciation should always be an active issue. I believe that two per cent. on buildings and four per cent. on machinery, for plain goods mills is ample depreciation, providing the necessary repairs are made. A two per cent. depreciation on buildings would provide for any minor charges in construction necessary for the arrangement of new machinery. If five per cent. should be taken as a basis of depreciation on the entire property, at the end of twenty years, if deducted annually from the cost price, the entire cost would be wiped out, but if deducted annually from the depreciated value, thirty-six per cent. of the original value would remain at the end of twenty years.

In 1876, FREDERICK LEIGH said before this Association that the object of depreciation was "to preserve revenue intact and to guard against its being divided in profits; to insure that revenue paid back to capital what it insensibly takes away." He explained that the English system was to charge off ten per cent. on boilers, 7½ per cent. on fixtures, five per cent. on general machinery, and 2½ per cent. on buildings, which would create a sinking fund that would provide for the replacement of antiquated machinery with the more modern. This system has kept English manufacturing plants at the highest efficiency.

The present practice in England is to deduct seven and one-

half to ten points a year from the original cost of the machinery. This amount is fixed by the articles of association and assures a credit which provides for loans at low rates of interest. These loans frequently amount to half the capital, and while legally subject to call, are practically permanent loans as long as the plant is preserved by measures such as the above.

The practical meaning of depreciation in connection with the cotton industry is an annual allowance made to cover the inevitable deterioration in machinery and buildings, so that there will be automatically created a fund to replace the machinery or plant when it can no longer be worked economically. The economic definition of depreciation is the paying out of revenue of a sum equal to the amount of capital absorbed in the earnings of revenue. This amount set aside, should not be a mere ledger account, or profit and loss item, but should be present in the form of liquid assets, so that the moment it is required it is available.

EMPLOYEE — STOCKHOLDERS.

In connection with this subject, I wish to call your attention to a project that has never been publicly considered in connection with the textile industry. The United States Steel Corporation, the largest corporation in the country, now has 96,000 stockholders on its books, and of this number, one quarter are employees of that corporation. In discussing this matter with RICHARD TRIMBLE, treasurer of the United States Steel Corporation, he stated that pursuant to their last offer to employees to subscribe for their preferred stock, there were subscriptions received from 25,089 employees, or about twelve per cent. of the total number employed by that corporation. This stock, sold to the employees, is purchased in the open market by the corporation and sold to the employees under their subscription, and Mr. TRIMBLE said he could see no reason why cotton manufacturing corporations could not adopt the plan with benefit.

This employee-stockholder plan promotes a greater thrift and secures higher efficiency from operatives by the encouraging of

PRICE MOVEMENT AND INVESTMENT RETURNS OF RAILROAD BONDS AND COTTON MILL STOCKS.

TITLE OF BOND.	1907. High.	1907. Low.	Range.	Price Apr. 1st, 1908.	Investment Return. (Per Cent.)	NAME OF STOCK.	1907. High.	1907. Low.	Range.	Price Apr. 1st, 1908.	Investment Return. (Per Cent.)
A. T. & Santa Fe General, 4's,	102½	89½	13	99	4.05	Androscoggin,	160	141	19	150	6.66*
Baltimore & Ohio, 1st 4's,	102⅜	88	14⅜	98	4.10	Appleton,	130	125	5	125	6.40
Erie Consolidated, 4's,	88	68	20	64	6.10	Bristol,	120½	110	10½	110	5.40
Oregon S. Line, 4's,	94¾	75	19¾	89	4.80	Dartmouth,	315	300	15	300	5.33†
Southern Railway, 1st 5's,	113¾	90	23¾	90	5.50	Everett,	133	125	8	125	4.80
Union Pacific, 1st 4's,	102½	92¾	19¾	105	4.70	Lancaster,	126½	120	6½	125	4.80
Wabash, 1st 5's,	114	99⅝	14⅜	65	6.15	Massachusetts,	100	90	10	95	8.42
West Maryland, 1st 4's,	82½	59⅞	22⅝	62	6.40	Pierce,	311½	304	7½	305	5.25‡
Wheeling & Lake Erie, 1st 4's,	87½	71	16½	82	5.05	Lyman,	90½	83½	7	83½	7.23
Wisconsin Central, 1st 4's,	89	72½	16½	100	4.00	Whitman,	141	131	10	125	6.40

*10 per cent. extra Jan. 1st 1908.
†50 " " in 1907.
‡16 " " "

a corporate part-ownership. Not only will it create a nest egg for the period of life when physical activities are curtailed by the operations of nature, but it will develop a greater sense of responsibility, both physical and mental; will create closer relations between employee and employer, and will act as a damper on labor disturbances. As to the securing of this stock, it might be rather difficult at first, but as soon as it became known that the corporation itself was a buyer of its own securities there would be offerings direct to the mill treasurer, instead of to the general market. I offer this suggestion to those who do not believe in the creation of a broader general market for cotton mill stocks. There is no question in my mind but that we have entered upon an era of greater publicity, of a more intimate relation between employers and employees, and of the necessity for the revision of the rules, regulations and restrictions that have prevented many textile industries from a healthy, economic advancement.

FORM OF STATEMENT TO STOCKHOLDERS.

While securing information for my paper, I was requested by several cotton mill treasurers to work out a form of statement that could be adopted by mills that desired to give greater publicity to stockholders. I suggest a table giving the outstanding capital stock for the lifetime of the corporation; the gross earnings per year; the expenses, interest and taxes per year; the net earnings applicable to dividends; the rate and amount of dividends paid per year; the year's surplus after dividends; the grand surplus to date, and the number of stockholders for each year. I believe such a statement combines all of the essential facts that stockholders are entitled to. The present system of issuing reports to the State Treasuer is ambiguous and unsatisfactory to all concerned.

As an illustration, a large Massachusetts mill stated in their list of assets for the year ending June 20, 1907, that their real estate and machinery had the total value of $500,000. Why! I should have no hesitation in offering $5,000,000, for that

property and would consider it a bargain at that. In analyzing the public statements of assets and liabilities of cotton mill corporations it is extremely difficult to satisfactorily determine the asset value of the capital stock or the earnings, on account of the many opportunities for covering up sources of equity. It may be all right from a cotton manufacturer's standpoint to cover up equity and hide earnings, but, from an economic standpoint, it is a violation, for which there is little or no justification. In the days when the cotton mill was owned and controlled by a family, there is no question but that secrecy was a desirable and necessary factor, and fifty years ago, when cotton manufacturing and allied industries were partnerships, that might have been justified; but in fifty years, the cotton industry has grown from a capital investment of $100,000,000, with a product of $115,000,000, to over $600,000,000 capitalization, with a product value of $450,000,000, and yet we still have the old systems of accounting, of publicity to stockholders and to the public. In other words, the manufacturing end of the cotton industry has made tremendous economic advances, while the financial end has maintained inertia. It is a well settled law that a corporate charter constitutes a contract between the corporation and its stockholders, determining the exact and only purpose for which the stockholders' funds may be employed. Upon this principle of law rests the stability and honesty of management of corporations, and upon it is based the confidence, safety and protection of stockholders.

LISTING ON THE BOSTON EXCHANGE.

At the present time there is just one cotton mill stock listed on the Boston stock exchange, which is the Amoskeag Manufacturing Co. of Manchester, N. H., and I am told that this stock was listed more for sentimental than commercial reasons. Certainly transactions do not indicate any advantage from this listing, as, thus far, there has been but one sale and that was made to establish an initial quotation. It would not be difficult for New England cotton mill corporations to have their securities

listed upon the Boston stock exchange, and the advantages accruing to the creation of such a trading center for securities would be tremendous. I have no hesitancy in saying that there would be less fluctuation in the market quotations and better standing of cotton mill stocks from a collateral standpoint.

In conversation with an official of a Boston bank, I was told that a borrower on cotton mill stocks cannot put up his security for collateral within 10 per cent. as much value as the borrower with listed stock exchange collateral. That is to say, where 80 per cent. of the current market value could be borrowed on listed stock exchange securities, but little over 70 per cent. could be borrowed on cotton mill stocks at their current market value. The reason for this is apparent. The present market for cotton mill stocks is confined to two auctions per week in Boston and a comparatively small "Over the Counter" business created by a few investment securities houses.

The following requirements are necessary for the listing of stocks on the Boston stock exchange:

Name of Company; purpose for which organized; date of incorporation; under what law incorporated; amount of authorized capital stock; amount of capital issued; amount to be listed under the application; amount unissued and for what purpose reserved; par value of shares; amount paid in on each share and in what manner paid (stating amount of stock paid for the property); is stock assessible; dividends paid if any; is any of this stock pooled or held in trust? full particulars required; location of principal office; location of transfer office, and name of transfer agent; place of registration; names of officers; names of directors. Separate papers plainly marked are required for each subject that follows; description and location of property, with map, if any; last report of company's treasurer or directors; certified copy of Charter and By-Laws of company; certified copy of court records, if any; detailed statement of present financial condition of company (showing debts and resources); list of stockholders, with number of shares to each; letter from transfer agent accepting office; letter from registrar

accepting office; letter from counsel in legality of incorporation; copy of stock certificate (cancelled); detailed statement of bonded indebtedness; contract with registrar. All copies of deeds must be certified by Registrar of Deeds where recorded. Copy of Charter must be certified by Secretary of State where incorporated. All other certifications must be made by a Notary Public, who must state that he has compared the copy with original and it is correct. Trust organizations must also send a copy of the Deed of Trust. In making the application it is hereby agreed, as a condition precedent to the listing of the stock, that the company shall furnish to the committee, at any time, on demand, such reasonable information of its general condition as may be required, and that failure to give such information shall subject the Company to the penalty of having its stock stricken from the list, and in consideration of the listing of the stock, it is agreed that reasonable notice shall be given the Boston Stock Exchange of any intended increase of the stock or funded debt of said Company or Corporation, and also due notice of closing of transfer books for any purpose. The Boston Stock Exchange reserves the right to strike any security from the list at any time. The face of every bond, coupon or certificate of stock must be printed from steel plates which have been engraved in the best manner, with such varieties of work as will afford the greatest security against counterfeiting. For each document or instrument there must be at least two steel plates, viz.: a *tint plate* from which will be printed a 'non-photographic' color, so arranged as to underlie important portions of the face printing, and a *face plate* containing the vignettes and lettering of the descriptive or promissory portion of the document, to be printed in black or in black mixed with color. These two printings must be so made upon the paper that the combined effect of the whole, if photographed, would be a confused mass of lines and forms, and to effectually secure against counterfeiting by scientific or other processes; and the imprint of each denomination of bonds shall be of such distinctive appearance and color as to make it readily distinguishable from other denominations and issues. This

above rule includes certificates of deposit. In certificates for 100 shares, the figures must be engraved upon their face, and certificates for less than 100 shares must be printed in a different color and the words "Certificate for less than 100 shares" must be engraved upon the face.

Each original application for listing securities must be accompanied by a check for the amount of $100 for $2,000,000 or any portion thereof, of the par value of security presented for listing; $50 more for each additional $1,000,000 or portion thereof; $500 for $10,000,000 and over. For listing additional amounts $50 for each additional $1,000,000 or portion thereof, up to a total capitalization of $10,000,000. Said check should be drawn to the order of the treasurer of the Boston Stock Exchange and will immediately become the property of the Exchange.

It is required that a sample of each issue of stocks or bonds sought to be listed shall be referred to the committee for acceptance as to form, character, and workmanship, prior to application for their listing. No form of stock certificate or bond will be accepted unless it has been carefully engraved by some bank note engraving company whose work, the committee on stock list has been authorized, by the governing committee, to accept for admission to the list.

From the above it appears that the requirements for the listing of securities on the Boston stock exchange, are not severe, and the ratio of advantages accruing from listing, to the disadvantages of giving the above information, are self evident.

The PRESIDENT. This is certainly a very valuable paper.

The SECRETARY. I have received this telegram of cordial and fraternal interest to all.

CHARLOTTE, N. C., APRIL 16, 1908.

C. J. H. WOODBURY,

Secretary, National Association of Cotton Manufacturers, Boston, Mass.

The American Cotton Manufacturers' Association extend greetings to the National Association of Cotton Manufacturers and wishes them a most happy and successful meeting.

C. B. BRYANT, *Secretary.*

Mr. MACCOLL wishes me to call attention to the meeting of the Committee on Resolutions at 9.30 tomorrow morning. The list of the Committee is written upon the blackboard and if any member has any subject which he thinks ought to be brought before the Association in the form of a resolution will he please hand it to Mr. MACCOLL.

The PRESIDENT. We now are to listen to a paper from an ex-president of this Association and one who has had much experience in dealing with the subject which he is to talk to us about, in connection with his presidency of the two International Conferences, the one at Washington and the other at Atlanta, of both of which he was the president. I have the pleasure of introducing Mr. JAMES R. MACCOLL. [Applause].

THE NEED AND ADVANTAGES OF A COTTON EXCHANGE IN NEW ENGLAND.

JAMES R. MACCOLL, Providence, R. I.

In an address delivered a year ago to this Association, I referred to the advisability of establishing a Cotton Exchange in New England. The suggestion called forth many comments and criticisms. The latter were, to a large extent, based on a misapprehension as to the purposes and methods of such an institution. To many minds a Cotton Exchange is associated with so-called gambling in futures, and therefore, it is not wanted in New England. The object of this paper is to explain more fully my views regarding the organization and work of an exchange adapted to the present requirements of manufacturers and merchants in this vicinity.

The best model for us to follow is the Bremen Cotton Exchange, the membership of which is composed jointly of spinners and merchants, the former being in the majority. This differs radically from the New York Exchange, in which membership and management are confined to cotton merchants, and from the Liverpool Exchange, in which spinners are admitted only as associate members. In England there has recently been much criticism of the existing arrangement, which permits only two spinners to represent their interests on the Board of Directors, while the cotton dealers have a representation of fifteen.

In Bremen the union of the two interests has been attended with marked success and satisfaction. In addresses delivered at the Bremen Congress of the European Federation in 1906, HERR PLATE, president of the Exchange, said: —

"It came to us as an inspiration that the only way to combine these two interests would be to put them together in such a way that the one should control the other. We found that there was no possibility of gaining confidence with our spinners, nor did our spinners believe there was a chance of gaining confidence with our dealers unless a system was arrived at which would produce the combination actually created in the Bremen Cotton Exchange, where spinners and dealers work together under peaceful conditions and in a most efficient manner.

"The number of spinner members in our Cotton Exchange is more than double the number of our dealers, and that will enable you more than anything else to exactly understand what we have arrived at. I confess I never heard of any combination between trade and industry similar to this, the Bremen Cotton Exchange.

"I feel certain that the more you enter into the details of the system that obtains in the Bremen Cotton Exchange, the more you will find that we have, after severe strife, arrived at a solution which seems perfect."

HERR CRAMER, vice president of the Exchange, said: —

"Thus it came about that the industry also strongly desired the establishment of a large cotton market in Bremen, and in 1886 the Bremen Cotton Exchange was founded.

"The close union between cotton merchant and spinner which was created by the Cotton Exchange was a means of placing the cotton trade on quite a different basis."

An extract from a recent report of the Bremen Exchange also emphasizes the same feature: —

"The following figures are a striking proof of the harmonious and loyal co-operation of both branches of the trade.

"Whilst in the year previous to the joining of spinners to the Bremen Cotton Exchauge 430,000 bales were imported, and 151,000 bales arbitrated, in the following year 1887, the import rose to 658,000 bales and 300,000 bales were arbitrated. Ten years later, 1897, the import amounted to 1,400,000 bales and 1,090,000 were arbitrated."

In the year 1907 the import reached 2,141,754 bales, and 2,396,128 bales were arbitrated, the difference we presume being accounted for by imports of the previous year receiving arbitration in this period.

The first point that I make is that we need in New England a Cotton Exchange in which merchants and manufacturers shall work unitedly for the development of the industry, and together shall establish rules of trading, and settle differences that may arise. Its directorate should be composed of representative men from the leading cotton centers, such as Boston, Providence, New Bedford, Fall River, Lawrence, Lowell and Manchester.

Take for example the question of tare. The Arkwright Club, composed of mill treasurers, has endeavored to establish a 22-pound tare standard. Some of its members buy on this basis, others on 24-pounds tare, and others without any restriction regarding tare. Some cotton merchants and brokers acknowledge the 22-pounds standard as equitable, and others say they never heard of such a requirement. A ruling regarding tare, decided upon by a directorate such as I have described, would be official and final as a basis for trading in New England. There are many other questions that need to be settled in the same way.

In a recent letter Mr. H. W. MACALISTER, chairman of the European International Committee on Cotton Exchange Contracts, says:—

> "I should like very much if we as a trade (every nation and all of us) would agree to arrange to buy cotton upon one principle, viz.: net weight of cotton delivered. If this could be arranged it would be the best incentive possible to improvement in covering and pressing cotton."

The influence of a New England Exchange in bringing about this desirable feature of buying on net weight, would be very marked in co-operation with the European Federation.

The Bremen Exchange has no trading in futures such as exists in New York, New Orleans and Liverpool. In these markets the grade "middling uplands" is bought and sold, but deliveries may be made of many other grades at differences fixed either annually as in New York, or at time of delivery, as in New Orleans and Liverpool. The method which prevails in

Bremen is that the exchange establishes fixed standards of grade and staple, and the spinners purchase for present or future delivery the actual cotton that they need and use in their mills. When the coton arrives it is sampled and arbitrated by exchange officials to determine whether the delivery equals the standard in grade and staple. If inferior to the standard bought, the difference in value is allowed, and also if the deficiency is important, a penalty is imposed on the shipper. On this matter HERR CRAMER, says: —

"The fine may under certain circumstances even be as high as ¾ cent per half kilo, or approximate pound. Of course, the trade is not in a position to stand these heavy fines often or even occasionally. Consequently, every merchant will take good care not to have any fine to pay, and the effect of the clause is that the spinner receives as a rule his proper quality."

It is useless to advocate the establishment of a system that would not be mutually advantageous to shippers, merchants, brokers and spinners. Allow me, therefore, to elucidate this point. The Southern dealer or shipper would benefit, because in quoting prices, he would know that he and his competitor for the order were both quoting for an exactly understood standard. At present, mills differ in their idea of grade and staple, and many an order is lost by a dealer because he has in mind when quoting, a better grade or staple than the mill requires, or than his competitor is proposing to deliver. Then again the exchange arbitration necessitates a fair delivery. First class shippers know that they suffer by the quotations of irresponsible parties, who do not intend to deliver cotton fully up to what they sell. The capable and honest trader is thus protected and rewarded.

The broker or merchant shares with the shipper these advantages and also is saved a vast amount of trouble and risk.

From the spinners' standpoint, there would be great benefit in a thorough system as regards standards and arbitration. There is a wide difference in the methods now prevailing at different mills in examining cotton received. A treasurer

recently told me that he used 30,000 bales annually, and personally passed every bale. In some mills a competent classer is employed. In other mills the superintendent or the overseer of carding is relied upon to pass the cotton, and in many mills I am informed that there is no examination worthy of the name. A few concerns send their cotton to the New York Exchange to be classed. It is generally recognized that New York arbitration is not adapted to so called "staple" cottons. Last year the New York Cotton Exchange classed for spinners only 15,000 bales, which shows that it is not utilized to a large extent for this purpose. The lack of competent classification must undoubtedly be detrimental to the production of many mills. The adjustment of claims with brokers and shippers is by no means an easy task, and generally is in the nature of a compromise. The Bremen system provides for arbitration by two sworn classers, with an appeal to a committee of members of the Exchange. In my judgment there is a great advantage in two men working together and comparing their findings on each bale as they proceed. Every man who has tried to classify cotton will, I think, agree with me in this opinion. So well is the work of the sworn classers done at Bremen that of 2,396,128 bales arbitrated in the year 1907, an appeal was made on only 208,402 bales, or less than nine per cent. The Committee of Appeal sustained the sworn classers' judgment on 96,835 bales, and reduced or increased the allowance on 111,567 bales.

The cost of classifying in Bremen is about five cents per bale, and in New York, ten cents per bale. For stapling 6¼ cents per bale is charged in Bremen. Suppose that it cost a mill using 10,000 bales of cotton annually, $1,000 to have its cotton classified, would this amount not be far more than recovered by the saving of the time of its own men, and by the improvement in its product through the uniformity and the maintenance of quality of the cotton used.

Recent years have witnessed remarkable changes in the marketing of the great Southern crop The increased wealth in the South and the influence of the Cotton Growing Associa-

tions have been manifested in the building of hundreds of warehouses and in the endeavor to market the crop slowly throughout the year, instead of in three or four months. It is difficult to obtain statistics of the number of warehouses built, but I am informed that in Texas alone over 300 have been erected, capable of holding 600,000 bales. At Memphis, there has been constructed a splendid system of modern fireproof buildings with a capacity of 200,000 bales, with plans for doubling in the near future.

If the warehouse system is still further developed in the future, it seems to me entirely practicable for a New England Exchange to trade in warrants or certificates of actual cotton held in Southern warehouses, either for immediate or future delivery. It is admitted that there would be difficulties to overcome, such as unreliability of classification, but there is no insurmountable obstacle in the way of a final accomplishment of this plan.

A committee of the New York Cotton Exchange has advocated the certification of cotton in Southern warehouses, and also the trading in actual cotton, which would result therefrom. The following extracts from the committee's last report are interesting in this connection:

"By the natural enlargement and development of this certificate system our Exchange will perform for the whole trade its true function, by bringing the buyer and seller together to trade upon a fair basis with the very least amount of risk or delay or uncertainty or loss."

"There is not an objection to this plan that cannot be met and overcome, either absolutely, or by greater advantages in other ways."

"But now extend our system, certificate in warehouses in the South even running lines of grade and also of staple cotton, display these samples in New York and give the spinner just what he is asking for, with the extra advantages of a guarantee of the grade."

"With all these advantages spinners will seek to join our Exchange (just as brokers and dealers do now) and as the export business grows they would meet upon our floor with the cotton sellers and the export buyers. Will not drawing spinners into our Exchange insure us a large amount of new business?"

Why not secure for a New England city the working out of this system? The logical location should be in New England where two thirds of the spindles of the country are located, and 2,500,000 bales of cotton are annually consumed. It is in New England that most of the finer classes of goods are made, and especially as regards staple cotton, a central market would be of great advantage. The proposed system of certificating cotton would be equivalent in many respects to a spot market in New England, but it might be found profitable and advantageous to go further and carry stocks of spot cotton at this center as wel as in Southern warehouses. It should be remembered that frequently the stock of cotton in Liverpool is over 1,000,000 bales and always amounts to several hundred thousand bales. There is no reason why a system that English merchants and spinners find mutually profitable should not also be desirable for our New England manufacturers, for as regards time of transportation of cotton, Boston and Providence are as distant as Liverpool from Southern shipping points. Many mills are borrowing money at high rates of interest to carry for months cotton that they do not need. They could effect a distinct economy by purchasing spot cotton as their requirements developed. This phase of the problem might be further elaborated both as regards the economical financing of certificated cotton, and the saving in freights by sea transportation to one central New England point.

Before closing, I wish briefly to refer to the subject of "trading in futures" as carried on by the large exchanges. This question has recently been much discussed; Congress has ordered an investigation of Cotton Exchanges and the report from the Bureau of Corporations is eagerly awaited; bills are before Congress which if they become law, would practically annihilate the Exchanges. In connection with this subject, it seems to me that many sophisms have been promulgated. It is said that future trading is a necessity to the industry. Why should it be so, if the wool crop of the world, amounting in value to $500,000,000 annually, as well as the silk and linen crops, are

marketed successfully without trading in futures? This system does not finance nor move the crop, and it certainly affords great opportunity for speculation, which is injurious to legitimate industry. The speculator claims to "foresee" coming conditions. Unfortunately this is not his chief business. It is to create temporary artificial conditions by selling quantities of cotton that he does not own, or buying cotton that he does not intend to accept delivery of. In the long run it must, of course, be admitted that supply and demand regulate price, but in the intermediate artificial fluctuations, the speculator makes his money, and the grower and manufacturer are apt to suffer disaster.

The advantages of the future market are to be found in the insurance which it affords to those who are moving the crop; the opportunity to buy and sell immediately for any month in the future, and the hedge which is provided to cover distant sales of goods or stocks of cotton. I am not in favor of abolishing a system which has many advantages, and which has become so firmly ingrafted to the industry. In fact, I believe that both grower and spinner may have to avail themselves more frequently of the hedge which futures afford, in order to reduce the speculative features of their business.

Everything possible should, however, be done to root out speeulation and gambling and to make the Exchanges subservient to the interests of growers and spinners. The discussion of recent years has, I believe, made it clear, that the differences in tenderable grades should be adjusted continually by market value and should not be fixed for a long period; that each 100 bales tendered should be practically uniform in grade and staple and thus suitable for spinners' use; also that the extension of Southern warehouses, and the tendering on contracts of certificated cotton will tend to steady prices and prevent corners. Another suggestion that seems to me eminently practicable and likely to make "futures" more useful to spinners, is to trade in three grades instead of one (say low middling, middling and good middling) with a penalty imposed in addition to the

market difference, for the tendering on contract of another grade from the one purchased.

As American Manufacturers we are interested in the prosperity of the Southern States and desire to see them supplying the great bulk of the world's cotton. The closer union that has recently been accomplished between growers and spinners, as witnessed at the International Conference of Cotton Growers and Manufacturers held at Atlantà, Ga., October 7 to 9, 1907, will eventually result in getting rid of the useless parasites that fatten on the industry, and in securing the transference of cotton from grower to spinner with economy and justice to both. To this end, the establishment of a New England Cotton Exchange would be an important contribution. The future of cotton manufacturing in New England, although for the moment discouraging, is full of promise. There must be enormous expansion and development in the years to come. Manufacturers, merchants and bankers should co-operate to control the trading in the raw material, which is incidental thereto, and place it on a sound economic basis.

The PRESIDENT. Has any one any questions to ask about this paper? It is certainly one which will deserve careful consideration and ought to be of such interest as to bring out some remarks. The Chair awaits comments. I have no doubt Mr. MACCOLL will be very glad to answer any questions that are presented.

The next subject is Improvements in the Cotton Fibre from Storage of Seed Cotton.

The SECRETARY. Mr. President, for preserving its place on the record I will merely state that at the conference at Atlanta, on the question of the packing and baling of cotton several of

the leading cotton planters advocated the storage of seed cotton from thirty to sixty days, explaining that during that period the oil from the cotton would enter into the fibre, making it slightly of a creamy tint and more flexible, so that it would spin better, easier and with less waste. The advantage of that creamy line of cotton of course is well known to manufacturers. Further than that, it was claimed that this growth of the nutriment of the oil in the cotton seed would lengthen out the shorter fibres and average up the fibre. It was not claimed that it would increase the length of the longer fibres but that it would increase the length of the shorter fibres. There was not an American manufacturer or a foreign manufacturer there — and the foreign representation included Great Britain, the Continent of Europe and representatives from South America — who knew anything about that subject; it was entirely novel to them. As soon as the conference was over I wrote to our good friend — for he is a friend of the cotton manufacturing interests, the Hon. JAMES WILSON, Secretary of Agriculture, stating that if his department had information upon that important subject it would be of great advantage to the cotton growing and the cotton manufacturing interests to publish it, a crude estimate reaching two or three million dollars on the cotton crop alone, and furthermore I requested that if he did not have any such information would he start a line of investigation which was suggested in some detail. The response was prompt and cordial. The work has gone ahead and I expected to have a very full report at the present time. However, I have this letter of March 30.

March 30, 1908.

Mr. C. J. H. WOODBURY, *Secretary and Treasurer,*

The National Association of Cotton Manufacturers,
Boston, Mass.

Dear Sir:—I have your letter of the 21st instant, in relation to the investigation being conducted by this department of the growth of the

fiber of seed cotton in storage and beg to state that we regard the test undertaken last fall as inconclusive, for the reason that it was not begun soon enough. We have one series of ginnings where the cotton was ginned immediately after being picked and a quantity of fifty pounds ginned each week thereafter for nine weeks, having received thus far but one report from a cotton grower, in connections with these ginnings.

We have, however, sent samples to several cotton spinning firms in the north and hope to have reports from them within a very few days. The claim is advanced by the advocates of this system of storing cotton that the gain in the length of fiber is very much larger in cases where the cotton has been stored early in the season.

We are thus not desirous of publishing the results obtained from our necessarily late test of this season, preferring to delay this matter until we have had opportunity to make a further test next year, I think it will be possible, however to prepare a statement, showing the results of our test, including all reports, in time for presentation at your meeting on the 16th and 17th of April.

Very truly yours,

JAMES WILSON.

Secretary.

The SECRETARY. It is a matter of great importance and further information on this subject will be inserted in the Transactions whenever obtained.

The PRESIDENT. The next paper is upon Egyptain Cotton, by an expert on this subject, one of our members, Mr. P. N. CARIDIA.

EGYPTIAN COTTON.

P. N. Caridia, Boston, Mass.

Egyptian cotton has steadily gained such favor in the markets of the world that information relating to the manner in which the staple is treated until it is shipped and to its principal varieties attracts attention within a much wider circle than would have been the case a few years ago.

Without touching on the question of the constitution of Egyptian soil or the technical side of its culture which have been dealt with by competent specialists it may be pointed out that owing to the unremitting attention of the Government of Egypt and to the efforts and scientific advice of the Khedival Society of Agriculture, each year has marked a step forward in the methods adopted. Agricultural expositions orgainized by the society in the interior of Egypt have been of great benefit. The Fellah has begun to realize that it is to his interest to follow the path of progress which has established the reputation of Egyptian cotton. It is interesting to follow some of the new cultivators who start cotton growing in some districts without any previous experience. They contrive not only to improve their method of cultivation from year to year, but to give the staple every necessary attention, from the picking, to its delivery to the merchants. It is fair to add that among the large exporting firms, those which have agencies in the interior, have taken a large share in improving the qualities grown in all the districts. Their efforts to select the best seed for sowing purposes and to insure full deliveries of the qualities they buy have given the grower to understand that the only way to obtain a profitable

price is to carefully nurse his crop and to provide a uniform quality.

Irrigation is the corner stone of Egyptian culture and it is only by the organization of irrigation that Egypt has attained its present prosperity. The system has been methodically improved during the last 25 years under the management of English engineers to whom Egypt will for ever owe a debt of gratitude. During the period of the low waters of the Nile, which exactly corresponds with the cotton planting and growing season, the application of a system of rotations insures to each cultivator in turn a prearranged quantity of water fixed by the Department of Irrigation according to the outlook of the condition of the Nile. The application of the system of rotations ceases towards the end of July when the water of the river is plentiful. The government has now turned its attention to Upper Egypt, where the construction of the Assouan dam which was completed a few years ago, was a starting point for supplementary canals. These will insure for Upper Egypt the same advantages as they have given to Lower Egypt.

The area under cotton and the crops produced were for the last two years as follows:

1906.	Lower Egypt,	Feddans,	*1,260,099.	Crop, Cantars,	†5,899,000
	Upper "	"	246,138.	" "	1,050,000
	Total,	Feddans,	1,506,237.	Total, Cantars,	6,949,000

The total average yield per Feddan or acre, was therefore cantars 4.61, say 460 pounds. (For lower Egypt it was cantars 4.68 and for Upper Egypt cantars 4.27.)

1907.	Lower Egypt.	Feddans,	1,289,315,	estimated crop, Cants	5,600,000
	Upper "	"	313,956,	" " "	1,400,000
	Total,	Feddans,	1,603,271,	Total Cantars,	7,000,000

Total average yield cantars 4.63. (For Lower Egypt cantars 4.34 and for Upper Egypt cantars 4.46.

*A Feddan = 1.038 acre.

†A Cantar of 100 Rotolis = 98½ lbs.

The above figures for the cultivated areas supplied by the Ministry of the Interior are approximate. It is probable that the cultivated areas may be somewhat larger. It will be remarked that a considerable increase is shown for Upper Egypt. This is due to the construction of new canals in that region. It is not probable that production will vary much in Lower Egpyt because growers have already increased the proportion of their land under cotton from one third, which was considered a reasonable proportion, to one half. Any increase will, therefore, be mainly due to the reclamation of new land of which there is a considerable quantity in some districts.

A very important question for the future of Egypt is the fact that the soil is getting poorer. This is attributed to the too frequent rotations of cotton, although the causes of this deterioration have not been clearly defined. It is pointed out that in past years with an area under cotton considerably inferior to the area at present covered, a crop was produced approaching last year's crop in size. There is at present some talk of calling together a commission of competent men to probe this vital subject.

A further serious question arises from the fact that in Egypt each variety of cotton gradually deteriorates in quality and color. The outturn also deteriorates. Fortunately other varieties have appeared in time to take the place of the growths which had deteriorated.

Since cotton has been grown in Egypt about a century ago, many varieties have appeared and disappeared. Such were the Gallini, the Achmouni, the Bamieh and the white Zifta cotton (which had nothing in common with the Abbassi cotton now grown.) These have been replaced by Mit Afifi, Abbassi, Yannovitz and Nubari. Mit Afifi is the chief product of lower Egypt, whilst upper Egypt grows Achmouni almost exclusively.

Cotton is sown in Egypt from the middle of February, until April according to locality. This year owing to heavy rains, sowing appears to be three weeks late. The principal varieties grown in lower Egypt are the following:—

MIT AFIFI. This growth first attracted attention in 1888, although for several years previous to that date it had been grown by the growers of the village called Mit Afifi. The seed from which it sprang was produced by the villagers. The growers took to this variety because they found that it stands drought and attacks by worms better than other varieties. It requires less attention for picking and proportionately to other growths it gives a better outturn in ginning. Its brown color, (which, however, has a tendency to become lighter) the length and strength of its fibre have appealed to spinners.

ABBASSI was produced in 1895 by a Greek named PARAHIMONA who named it after the present Khedive of Egypt. This growth appears to have sprung from imported seed. The cotton is white and its fibre is longer and more silky than Mit Afifi.

YANNOVITZ. This variety was also produced by a Greek who gave it his own name. It is one of the best existing qualities in Egypt. Its fibre is long, strong and silky. The high prices it has commanded have tempted growers and its culture has increased in proportion to the spinner's demand.

NUBARRI is the most recent variety amongst the principal growths of Egyptian cotton. Its color is lighter than Mit Afifi.

SULTANI is a very long and silky variety. It has the principal characteristics of Sea Island cotton. The plant requires much attention and is easily affected by climatic conditions. Very little of this expensive variety is grown and it is probable that its production will remain small for the above reasons.

ACHMOUNI as above stated is the variety which is grown in upper Egypt. It is lighter in color than Mit Afifi and the fibre is not as long. Efforts to grow the lower Egypt varieties in upper Egypt, have not been successful and cultivators who have once tried, do not seem willing to renew the attempt. They feel convinced that the Achmouni quality is superior

The cause of this failure may be the want of experience of the cultivators of upper Egypt as regards the methods of cultivation of lower Egypt cotton.

Picking commences in September and continues until November or the beginning of December. Two, and in some districts three pickings are made. The greater the number of pickings the better for the quality because the fibres lose their lustre when open bolls are exposed to the sun.

After picking, the cotton is usually stored, except in some districts where the small cultivators place it in sacks as soon as picked. In the interior, the cotton in seed is sold to the merchants. The buyer oversees through his employees, the placing of the cotton in sacks, each quality is packed separately and the sacks are marked with different marks. This supervision is entrusted to men of experience to avoid the mixing of qualities. Many growers have large well aired stores which protect the cotton from any deterioration even if it is stored for several months.

Weighers licensed by the government are usually employed to weigh the cotton but this is not obligatory.

The sacks of cotton weighing 380 to 400 pounds once filted and weighed are transported to the ginning factory by the means which best suit the buyer; the railway, canal barges, camels, or carts. During recent years there has been a considerable improvement in the facilities of transport. Besides the state railways, roads have been built all over the country to replace narrow cross country paths, but they are not kept in good repair. Narrow gauge railways have proved of great advantage. They have reached districts which had previously been inaccessible from stations of the state railways.

On reaching the factory the cotton is once more classified and weighed.

GINNING. The large export houses have a network of factories in the principal districts. These factories usually contain 40 to 120 roller gins. Quite recently some factories have been enlarged and contain 160 and even 180 gins. The

Egyptian ginning factory is as a rule, fully equipped for treating the cotton with all the necessary care. These factories have vast storing space for cotton in the seed and besides their equipment of gins, they have hydraulic presses, automatic conveyors and sieves for the seed.

The Platt's knife gin which is in use, gins 100 to 110 pounds of lint per hour. Experienced hands are employed for regulating the gins because this requires special attention and experience. An experienced man runs the gins according to the quality of the cotton to be ginned, and, by regulating the distance of the knife from the roller, he avoids damaging the fibre whilst running the machine to its full capacity. The gins are placed in two and sometimes four, parallel rows facing the centre of the ginning room. The car running between the gins collects the lint and delivers it to the light hydraulic press which turns out bales weighing 800 to 900 pounds.

The seed falls in an aperture below each gin and is automatically conveyed to sieves which free it from dust and dead cotton, "Scarto" which escape the gin with the seed. The Scarto separated by the sieve is then passed through saw gins in a special room and separated from the seed. The ginned Scarto is sold at very low prices on the spot.

The seed of the best lots of cotton is carefully laid aside to be sold as seed for the next crop. The large houses give special and very careful attention to the selection of this seed. The remaining seed is sold as commercial seed in the interior, or in Alexandria to oil factories, or it is exported.

Some of the ginning factories are equipped with presses which turn out heavy pressed bales ready for export. Such presses are used by some of the large export houses. The latest system adopted for presses in the interior is the Elsworth patent. Mr. ELSWORTH is an engineer in Egypt. This press is inexpensive comparatively to the other presses and it works by hydraulic pressure through pumps worked by steam. It has three shallow boxes pivoting on an axle and turns out 25 to 30 bales per hour. It can therefore bale the daily production of a large

factory. It is not expensive to run. Each bale is made with the cotton contained in the three boxes. For the two first, the pressure is given by a ram of small diameter. At the third box the pressure is applied by three rams. The cotton is pressed to a density of 37 to 38 pounds per cubic foot.

From the ginning factories the cotton is transported to Alexandria according to the merchant's convenience by barges or by rail. Each important factory has a railway siding running into its yards.

Presses also exist in Alexandria for the heavy pressing of bales which arrive from the interior light pressed. These presses, considerably improved by the late Mr. DAVISON, engineer to Messrs. CHOREMI, BENACHI & CO., of Alexandria, are of a different pattern to the presses used in the interior. They are more expensive, but they can turn out 50 to 60 bales per hour. They have three deep boxes large enough to contain sufficient cotton for one bale each. The first pressure is applied by steam and changed to hydraulic pressure for finishing the bale. Both in the interior and in Alexandria each bale before leaving the press is circled by eleven hoops fixed with studs.

This brief sketch of the treatment of cotton from the time it is picked will show that no pains or expense are spared to give Egyptian cotton every necessary attention. The picking, the classing and the packing are done in a manner that should contribute to maintain the good repute which this staple has attained.

FIGURE 1—PICKING EGYPTIAN COTTON.

FIGURE 2—SEED COTTON ARRIVING ON CAMELS, Zagazig, Egypt.

FIGURE 3—DAHABIAS ON THE NILE, CARRYING SEED COTTON.

FIGURE 4 — GOVERNMENT RAILWAY TRAIN LOADED WITH SEED COTTON,
Kafr-el-Zayat, Egypt.

FIGURE 5—WEIGHING SEED COTTON,
Zagazig, Egypt.

FIGURE 6—TRANSFER OF SEED COTTON TO THE GIN ROOM.
Zagazig, Egypt.

FIGURE 7 — EGYPTIAN COTTON GINNERY,
Beni-Souef, Egypt.

FIGURE 8—ROLLER GIN ROOM,
Kefr-el-Zazat, Egypt.

FIGURE 9—HEAVY HYDRAULIC PRESS,
Zagazig, Egypt.

The PRESIDENT. A very interesting paper. Has anyone any questions to ask? I will call upon Mr. HASERICK for comments.

Mr. ARTHUR A. HASERICK. Mr. President, I think that is a very interesting paper. I have not studied the subject enough to ask any questions about it. It was full of valuable information for all of us.

MEETING OF THE INTERNATIONAL FEDERATION.

The PRESIDENT. For the information of those present I will state that we have received a cable from the Secretary of the International Federation asking: "How many delegates and ladies are coming, definitely? Shall we reserve rooms?" I understand that none of our delegates are intending to take ladies with them, but I thought it possible that others might be going with them and if so I would like to be able to make some statement in reply to this cable. If any of you can give me any information I will be glad if you will kindly notify the Chair at your earliest convenience.

The next paper is upon Sea Island Cotton, by Mr. F. G. SCHELL, the Secretary of the Sea Island Cotton Association, Lake Butler, Florida.

The author is not present and it will be read by the Secretary.

SEA ISLAND COTTON,

F. G. SCHELL, Lake Butler, Florida.

In 1786 the celebrated Sea Island Cotton was first introduced in the United States and was first grown on Saint Simons Island on the coast of Georgia.

In 1785 it was brought from Angulla, an island in the Caribean Sea to the Bahama Islands and from the Bahamas to the coast of Georgia. From Saint Simons Island it reached the now famous Sea Islands of Charleston were the finest varieties are grown. Between the years 1825 and 1830 Mr. BURDEN of Johns Island, South Carolina, succeeded in selecting the black seed from which all the best varieties now grown in the United States originated.

The first of this cotton which was shipped to Europe was packed in wooden boxes similar to our orange boxes of today.

In geographical distribution the area of this cotton is limited. In the United States on a line drawn from Georgetown, South Carolina, to a point in West Florida following down the Atlantic coast in a half moon circular line about fifty (50) miles from the coast. The best staple grown outside of the islands at Charleston is grown in East Florida in the counties of Baker and Bradford. In these counties originated the market named "East Floridas." The conditions of soil in these two counties having a stiff clay subsoil within from 9 to 12 inches under the surface and overlaid with a sandy loam are perhaps the main reason why a better staple can be grown here than in any other place in Georgia or Florida. The Sea Island Cotton requires a great deal of moisture, far more than the upland varieties. The lands of Baker and Bradford are what are termed locally "Flat Woods

Lands." Moisture plays an all potent factor's part in the quality of the staple. In dry years we have a poor staple, wet years a good staple. The quality, uniformity, length, and color of the staple of the Sea Island Cotton are due to several causes. First, the planter has not had any practical inducement and encouragement of late years to grow fine cotton. Thousands of orders sent by the commission men to his local agent is for No. 2 cotton. The small white farmer who is punctual in paying the local dealer for his fertilizer and other farm supplies brings in his cotton to pay for them. The local dealer shows him his telegram order from the commissin man for the No. 2 cotton and the price set on it and the farmer sells his best cotton for a No. 2 price. Whenever the manufacturers get a practical inducement before the farmer in the way of a better price direct to him for his skill and extra care in growing a finer cotton then the question will be solved of growing a better staple and eradicating the evils of slovenly and slipshod management of the staple now prevailing.

The Nap and Crimping of the staple is nearly all due to careless management by the planter and ginner. The Nap from ginning wet cotton. The Crimping from careless adjustment of the gins. The waste can be reduced by careful drying and resorting the cotton before it is ginned. Another cause of deterioration is for want of new seed, it having been the custom of the Georgia and Florida planters to renew their seed every three years from the Islands in Charleston where they cannot now get them. For the Sea Island Association I have been instrumental in placing 500 bushels of new seed in limited quantities to the Georgia and Florida planters this season, and we now have an educational campaign projected for raising a finer and better cared-for staple. In the East Florida section we think by scientific care, skill and selection, our cotton can be brought up to 2 and 2¼ inch staple that will be uniformly long and strong and good color if the manufacturers of the world need this kind of cotton and will co-operate with us in our aims in the right way.

VALUE OF THE SEA ISLAND VARIETY.

The world's finest fabrics are manufactured from it. It is

costly to raise. The actual cost of growing it is from twenty-three and one-half to twenty-six cents per pound of lint. It is a shy bearer. The average yield is about 100 pounds of lint per acre. It takes from 3½ to 4¼ pounds of seed to yield one pound of lint.

It requires a long season free from frost until the middle of December to reach its maximum perfection and maturity. It is geographically limited in its home. It requires a moist climate and clay subsoil. A hundred years of time covering experiments have failed to grow it outside of the limits described in this article. It will degenerate in three years into a coarse, short and brittle staple unless improved by new seed or improved selection. It requires long training of the laborer to cultivate it successfully. It is hard to pick. The upland gatherer will not pick it. It costs from $1.25 to $1.50 per hundred pounds to pick it from the bolls. A normal crop for the area in which it is grown is from 90,000 to 110,000 bales. Nine tenths of which is grown in Georgia and Florida. In the limited area in which it is grown 500,000 bales can be produced if the world's consumption would enwarrant it at a fair profit to the grower. At the present high prices and scarcity of labor and prevailing prices for the staple it is not profitable to the grower. It takes the educated brains of the white man to grow it successfully and the cheaper labor of the black man cannot be used as profitably in growing it as can be on the upland or short staple cotton.

The Sea Island Cotton's fine manufactured products easily rank it as Queen of the fibre family with exclusive and aristocratic subjects chosen from the Anglo Saxon race on whose educated brain, skill and energy depends the maintainance of her production and supremacy.

The increase or decrease of the industry depends in a large measure on a fair profit to the producer and a closer aliance of the grower and manufacturer. We must know what grades and qualities of cotton you can assure us you can use profitably to us and your own interest. In behalf of the Sea Island Cotton Association, I ask your co-operation with the growers and will

cheerfully reciprocate in behalf of the Association in any and all efforts from the manufacturers either in America or the Old World.

The SECRETARY. I will say in this connection that persons wishing to read other articles on the subject of Sea Island Cotton will find them in papers on Sea Island Cotton, Transactions, Vol. 59, (Atlanta Meeting,) page 244, and Vol. 69, page 200, by ELIAS L. RIVERS, James Island, S. C., which were read at those meetings. Certain bales of East Florida Sea Island Cotton have been collected to be the basis of photographs to illustrate this paper, but the author wrote that they had been gnawed by rats so that they were not suitable subjects.

The PRESIDENT. Is there any business to come before the meeting? If not we will now adjourn until ten o'clock to-morrow morning, except, of course, for the banquet this evening, which I hope as many as possible will attend.

[Adjourned to Friday morning, April 17, at 10 o'clock.]

NOTE.—Thanks are due to Hon. J. SWINTON WALEY, of Edisto Island, a scientific seed expert, for historical data in this article.

THIRD ANNUAL BANQUET.

HOTEL BRUNSWICK, THURSDAY EVENING, APRIL 16, 1908.

The annual banquet was held on Thursday evening, April 16, at Hotel Brunswick. The company gathered in the parlors at 6 P. M., and after an informal reception took their seats at the tables in the banquet hall.

The following was the menu card:

MENU.

Little Neck Clams

Radishes Olives

Cream of Celery aux Soufflees

Consomme Windsor

Boiled Fresh Salmon, Butter Sauce

Cucumbers

Filet of Beef with Fresh Mushrooms

Delmonico Potatoes New String Beans

Lobster Cutlets, Sauce Cardinal

Roman Punch

Roast Jumbo Squab

Endive Salad

Philadelphia Ice Cream with Strawberries

Cheese

Coffee Cigars

Speakers.

His Honor, GEORGE A. HIBBARD,
Mayor of Boston.

WILLIAM WHITMAN, Esq.
President National Association of Wool Manufacturers.

Rev. FREDERICK W. HAMILTON, D.D., LL.D.
President Tufts College.

Hon. HARVEY N. SHEPARD,
Boston, Mass.

HENRY CLEWS, LL.D.
New York City.

Dinner Committee.

NATHANIEL F. AYER, Chairman.
ALBERT FARWELL BEMIS, ARTHUR T. BRADLEE,
GEORGE B. MORRISON, JAMES P. TOLMAN,
GEORGE W. ST. AMANT.

Music Programme.

KEENE'S ORCHESTRA
ARTHUR B. KEENE, Conductor.

1	March	"Pro Yalensi"	*Cowles*
2	Selection	"The Red Mill"	*Herbert*
3	Overture	"Jolly Robbers"	*Suppe*
4	Waltz	"Estudiantina"	*Waldteufel*
5	Patrol	"Siamese"	*Linke*
6	Selection	"The Merry Widow"	*Lehar*
7	Popular Songs		
8	Waltzes, from	"It Happened in Nordland"	*Herbert*
9	Selection	"The Grand Mogul"	*Herbert*
10	Entracte, from	"Mlle. Modiste"	*Herbert*
11	Intermezzo	"Manzanello"	*Robyn*
12	March	"Gardes du Corps"	*Hall*
13		"America"	*Smith*
14		"Auld Lang Syne"	*Burns*

Officers.

THE

NATIONAL ASSOCIATION OF COTTON MANUFACTURERS

Successor to

NEW ENGLAND COTTON MANUFACTURERS' ASSOCIATION.

In charge of the Eighty-fourth Meeting.

Presidents.

WILLIAM D. HARTSHORNE.

Vice-Presidents.

CHARLES T. PLUNKETT, GEORGE OTIS DRAPER.

Directors.

ROBERT BEATTY,
FREDERICK A. FLATHER,
GEORGE P. GRANT, Jr.,
EDWIN FARNUM GREENE,
FRANKLIN W. HOBBS,
JOHN W. KNOWLES,
WILLIAM H. LOFTUS,
HENRY F. MANSFIELD.
ROSCOE S. MILLIKEN.

Auditor.

C. E. ROBERTS.

Secretary and Treasurer.

C. J. H. WOODBURY.

The following guests were present:

P. H. Armington,
Nathaniel F. Ayer,
E. G. Bailey,
George S. Barnum,
Robert Beatty,
Albert F. Bemis,
John H. Binns,
Edmund E. Blake,
Arthur T. Bradlee,
S. Parker Bremer,
W. Irving Bullard,
Harry H. Butterworth,
Edmund Carrington,
Stewart F. Carter,
Albert Clarke,
Henry Clews,
James E. Coburn,
Alexander Corbitt,
William W. Crosby,
Samuel S. Dale,
Philip Dana,
Daniel J. Danker,

F. W. Dean,
A. DeCort,
Frank J. Dutcher,
Russell W. Eaton,
Frederick A. Flather,
Ellis Foster,
M. F. Foster,
A. L. Fowler,
A. H. Goff,
A. M. Goodale,
John M. Graham,
George P. Grant, Jr.,
Edwin Farnum Greene,
S. Harold Greene,
Frank J. Hale,
William Halliwell,
Frederic W. Hamilton,
Charles L. Harding,
William D. Hartshorne,
J. Fred Harvey,
W. M. Hastings,
William Carroll Hill,
Franklin W. Hobbs,
Robert J. Hoguet,
J. L. Honer,
George G. Houghton,
J. B. Jamieson,
Joseph C. King,
S. R. Latshaw,
E. A. Leigh,
H. F. Lippitt,
James Logan,
F. R. Low,
James R. MacColl,
Robert M. Macintosh,
H. F. Mansfield,
John P. Marston,
Henry D. Martin,
H. E. Mason,
Robert McArthur,
E. J. McGaughey,
James A. McDonald,
John MacManus,
Peter B. MacManus,
George B. Morison,
O. B. Munroe,
Arthur W. Newell,
E. Noble,
F. W. O'Brien,
Sidney B. Paine,
Edward Palmer,
Walter E. Parker,
C. H. Parsons,
Haven C. Perham,
Bernard Peterson,
Ralph S. Potter,
Theodore Ellis Ramsdell,
Israel P. Rounds,
Alfred Sager,
George W. St. Amant,
Dwight Seabury,
Albion K. Searls,
Harvey N. Shepard,
H. H. Shumway,
Louis Simpson,
George F. Steele,
Wallace I. Stimpson,
J. M. Sturgis,
Edward W. Thomas,
James P. Tolman,
William Whitman,
John G. Whittaker,
Fred A. Wilde,
Oscar W. Wood,
C. J. H. Woodbury,
G. A. Yeo.

PRESIDENT WILLIAM D. HARTSHORNE

in calling the company to order after the dinner said:

From a domestic point of view it is said that the way to a man's heart is through his stomach. Perhaps we might paraphrase this and say that the way to a man's head is through a banquet. No reflection is intended. Nevertheless, it seems to be true that until the gastronomic features of a banquet are well completed the "feast of reason and flow of soul" which is supposed to follow is not likely to be appreciated. Apropos of this statement a story is told of JOSEPH CHAMBERLIN, who was a guest of honor at a dinner at some town in England where the mayor was presiding. When they reached the coffee the mayor touched Mr. CHAMBERLIN on the shoulder and said, "Shall we let the people enjoy themselves a while longer, or shall we have your speech now?" [Laughter.] I am sure, gentlemen, I need not pass such a remark in regard to the gentlemen who are about to address us, for I am sure whether you have completed your gastronomic functions or not, you will be very glad to listen to them. I might here say that the next speaker was expected to be Mayor HIBBARD, who was to give us an address of welcome, but unfortunately he has been very closely engaged all day and also this evening, in matters connected with the great fire in Chelsea, so that he has been unable to come tonight.

It is said that a lawyer should know something of everything except perhaps the principles of law, which he could obtain from others at the moment he needs them. We have with us tonight one to whom this exception does not apply; a counselor learned in the law, and a man of affairs, whose utterances are molded in eloquence and grace; one who has been of great use to the cause of forest preservation, in which this Association is taking such an intense interest; not in the presentation of the facts about the flow of rivers or of forest culture, but by a masterly

elucidation before a committee of Congress of the constitutional principles which give warrant to the legislation proposed. I have the great pleasure of introducing to you Hon. HARVEY N. SHEPARD of Boston. [Applause.]

ADDRESS OF HON. HARVEY N. SHEPARD.

Mr. President, I am not quite sure, gentlemen, whether this greeting is because of the story the president has told of Mr. CHAMBERLIN and its application to myself, or whether it is because I am almost the only man present who has accepted the notice of this banquet as it is written and have come here in dress wholly informal.

I have been asked to say something in regard to the White Mountains Forest Reservation. Now, gentlemen, whether the amount of rainfall is affected at all by the presence of a forest is in doubt. But there is no doubt whatever that the retention of that rainfall depends very materially upon the existence of a forest. The soil which has accumulated under the trees, the leaves which fall year after year, act like a sponge in keeping back the water and make the escape regular, so that the condition of one month and another is about the same. If, however, you remove the trees, it is evident at once that you have no falling leaves year after year, the soil exposed to the hot sun dries, and the rains wash it away; and if it be upon a steep slope, in a little while you will have exposed the bare rocks which cannot hold back any of the falling rains. More than that, the melting of the snows in the spring washes the soil into the rivers; you have in the place of clear rivers, muddy rivers, you have great freshets in the spring, and in the summer you have a much diminished flow.

In Massachusetts we have two rivers, the Connecticut and the Merrimac which have their head waters in the White Mountain region. Once this region was covered with a dense evergreen forest. Then the early writers tell us that both the

Connecticut and the Merrimac had clear waters abounding in fish. Now, the forest has been nearly all removed and you have got far from clear water, and in the place of a steady flow month by month, very much the same in the summer as in the spring, you have a very great rush of water in the spring and comparatively little in the summer months. The lower portions of these rivers are navigable and therefore they come under the jurisdiction of the Federal Government, under the provlsions of our Constitution. It has been suggested then that Congress authorize the taking of the White Mountains in order to preserve the remnants of the forest yet remaining, and to re-forest, where the trees have been cut away, in order to preserve the navigation of these and the other rivers of New England which rise in the White Mountains. This is constitutional because it affects the flow of these streams, and because it affects the amount of the soil which washes into them. If it is legal for Congress to appropriate money to dig out year after year the soil that is washed into these rivers, certainly it must be also legal for Congress to appropriate money to prevent the washing into the rivers of this soil. If it is constitutional for Congress to appropriate money to build reservoirs at the head waters of the rivers of California, at the head waters of the Mississippi river, so as to make regular the flow of those rivers, can it be other than constitutional for Congress to provide a forest, which is the natural reservoir, to accomplish the same purpose for the Connecticut, the Merrimac, the Saco, and the other rivers of New England? That this would be an efficient means is proved to us by the experience of Italy and France. In fact, the lesson of France may be well taken home to us, for they are spending now more than $40,000,000 to bring back the soil and the trees upon the slopes of the mountains where they were removed under exactly the conditions that now prevail in our White Mountains. If it be constitutional for Congress to provide means to preserve the navigation of these two rivers, then, because that action also will accomplish other things, the legal foundation being once laid, is a strong and additional reason

for such action. And perhaps the greatest of these reasons is the relation of these rivers to manufactories. In the valley of the Connecticut we all know how many manufactories there are of cotton and wool and paper. On the Merrimac there are more manufactories carried on than upon any other river of the same extent in the world. In fact the amount of capital invested in the manufactories upon the four great rivers of New England which rise in the White Mountains is more than $250,000,000. Now, these depend very much for their successful working upon water power. The reason that they were established where they are is because water power was then found in these locations. It is not strange then, Mr. President that a great Association like this National Association of Cotton Manufacturers should have memorialized Congress to take action for the preservation of the forests in the White Mountains and the southern Appalachians, and your efficient secretary presented your cause with great ability before the Committee on Agriculture in January last. [Applause.] But, alas, you were alone in that representation. The manufacturers of wool, the manufacturers of paper, also have a vital interest in this relation of the water power to the existence of the forest, and they were not there.

We have also got near the end of the supply of wood and lumber which once was ours from the great forests which extended over New England. Soon the time will come, unless something be done, when there will be no more wood found here for fuel, and no more hard wood for use in the lumber industries.

It has been shown by European experience that it is perfectly possible to carry on a forest as a good farmer will carry on his farm, raising crop after crop, and yet without exhausting it, and in this way a forest can be maintained. It is not to be kept idle, it has to be cut when the trees have got to maturity, but always with provision made for the future. Our present method is the very opposite of this, it is a reckless waste, it is the stripping of everything that stands for lumber and pulp;

the debris, the tree tops, are piled up recklessly where fire can come and sweep it away, and then the soil is burned and nothing is left but the bare ledges, and that means centuries, of course, before there can come any replacing of the soil or of the forest.

There is another reason why I am in favor of the taking of these mountain reservations, a reason not of business, not of manufactories, not of trade, not of commerce, but of health and recreation. The White Mountains are the great playground of this section of the country. The people who have gone West from New England, and the descendants of those people, come back year after year to these mountains in the summer. I know of no form of exhilaration that is greater that can come to a man than when he has climbed a mountain; it makes him a better, a stronger, a more vigorous man physically, mentally and morally. If it be said, gentlemen, that this is sentiment, why, as a matter of sentiment, I do not hesitate to appeal that the mountains shall be saved to us with their forests standing. Sentiment! It is sentiment that has endowed our hospitals; it is sentiment that has built our schools; it is sentiment that attaches us to our flag; it is sentiment that has saved the battlefield of Gettysburg as a national monument; it is sentiment that erects statues; it is sentiment that leads us to put floral tributes on the graves of soldiers and sailors; and if it be only sentiment, then for sentiment alone I appeal that these White Mountains shall be saved to us, not as bare and naked rocks, but as the crowning glory of New England, clothed in the beauty of the forest as God gave them to our fathers. [Applause.]

President HARTSHORNE. A clergyman, it is said, may be greater than his pulpit, especially if there is a leaning towards something else. It was said of PHILIPS BROOKS that he was an Episcopal clergyman with a strong leaning toward Christianity. [Laughter.] We have with us tonight a gentleman

who has a strong leaning towards mechanics as well as mankind, derived from his early experience as a railroad man before he entered the ministry. So that now, as the president of a college, he is better able to follow the Greek philosopher's admonition "to teach youth those things which they will need when they become men." I have the great pleasure of introducing to you the Rev. FREDERICK W. HAMILTON, D.D., LL.D., president of Tufts College. [Applause.]

ADDRESS OF REV. FREDERICK W. HAMILTON, D. D., LL.D.

Mr. President and Gentlemen: It was with a great deal of pleasure that I accepted the invitation of my friend Dr. WOODBURY to come here tonight, because it seemed to me to be an opportunity to knit a little closer the bonds which in my opinion ought to unite the university with the world of business. The old conception of the university was that of a place where men were to be prepared for certain learned professions, and that until within a comparatively few years has been the principal function of the university. That period, however, has pretty largely passed. A very large proportion of the graduates of our universities are now finding their way into business, and many young men are going to college as a preparation for business. That has raised a considerable number of new problems which the university man has to face, and it is some of those problems that I want to talk to you about for a few minutes, speaking to the general topic of the education of a business man.

I remember only as recently as 1880, when I took my own Bachelor of Arts degree, a great many of my friends expressed surprise that I should have gone to college, in view of the fact that at that time I had no expectation whatever of a professional career, but expected to be a railroad man. As I expected always to be a railroad man, my friends thought I was wasting my time, and my father was wasting his money in procuring a

degree of Bachelor of Arts. I did not think so, and my experience as a business man shows me pretty conclusively that there was no mistake on either side. When I finally decided on a professional pursuit, my friends all came and asked me if I was not sorry that I wasted so much time in business, and I told them that there was nothing wasted there, because I considered my business life was a very important training for my professional and ministerial life. This simply demonstrates the fact that only as recently as twenty-eight years ago the college-bred man, who intended to be a business man was an anomoly. Now he is a common occurrence. And so there come these problems of the training of young men for business, problems which on one side are being met by the efforts of technical schools, and on the other side are being met and are to be met by the college of letters. A good deal of a question is coming up as to what should be taught in the colleges. We are hearing a great deal today about vocational training, about vocational training in colleges, about vocational training in the high schools, as if it was something new. I remind you that university training has always been vocational training, and it has never been anything else but vocational training. It took its form originally from the fact that college graduates were expected to go into certain professions in which certain subjects of study were particularly valuable. But as the conditions of society have changed and our modern social life has become more complex there has come about a demand for a greater range in academic training, and there is also, I think, coming about, a clearer conception of what is involved in the training of a business man.

My own idea about it, and the idea I am trying to work out in the college of which I am president, is that the important thing is not the kind of information that a man gets in college nearly as much as it is the amount of power which he gets in college. In other words, the purpose of the college is not to train a man so that he can go out from college and undertake the direction of any particular kind of business, but it is the

furnishing of a man with a certain type of mental equipment. It is not possible for a college to train a man so that he can go out and assume charge of a business, or even of a profession. It is possible, I believe, however, to give him those qualities of mind, and perhaps in certain degree also of character and of temperament, which will enable him to learn the business or the profession which he is to pursue more quickly, to pursue it with more success, and to carry it further than he can expect to do without that equipment.

We have law schools, but I think my friend, Mr. SHEPARD here will agree with me that a man does not become a skilful practitioner at the bar in the law school but that he simply gets started, and he learns his business in the office of the lawyer, and in the practise which he picks up in the courts.

We may teach a man the theory of engineering, as we try to do in the engineering department of the college with which I am connected, but he becomes an engineer in the office and in the field. And so of every profession he goes into. We cannot train a man for the conduct of business, but we can give him those qualities which will fit him to learn a business and to become successful in the conduct of it.

In my mind it is pretty easy to sketch what those qualities should be. A man who is going to be a successful conductor of business, a wise and skilful administrator, in these days, must, in the first place, be the master of his own power. He must be able to control, to direct, and to use all his natural powers, plus whatever degree of strength he may have acquired in the developing process of education. He must be capable of concentration. He must be able not only to command those powers but to address all of them to the solution of definite problems. There are a great many men who are very brainy men, and who have a vast amount of information, who are brilliant in a way, but who are not successful because they are not able to apply those splendid qualities directly and definitely to the solution of a given problem. He must not only be able to do things himself, but he must be able to use the brains and

abilities of other men. The days when a man could conduct his business for himself, by himself alone, have long since passed. Modern business has grown to immense proportions. The process of consolidation which has taken place within the last few years, comparatively, is a perfectly natural process, a perfectly inevitable process, an altogether praiseworthy process, and a process which is going to continue indefinitely. It is a process which leads incidentally to certain abuses because, if I may be allowed to lapse for a moment into the quoting habit of the preacher, " we have this treasure in earthen vessels." The men who run the consolidations are only men, and consequently they commit the mistakes, and some times the crimes, which men are prone to commit under all conditions, and under all circumstances. But the thing itself is a good thing, not to be opposed, and those who attempt to check the progress of consolidation are as unwise as they are short-sighted, in my humble opinion. Now, the man who is to be a success under those circumstances, clearly must be able to use his brain, he must be able to decide very quickly, and on the whole accurately on the basis of information which other men furnish to him. His heads of departments, his representatives here and there and everywhere, are to bring him the information, the results of their experience, the reports of what they are doing, the needs of their departments, the conditions of the work and all the other almost innumerable things which come under their immediate observation. He must be able to decide quickly what to do on the strength of those reports which are thus submitted to him, and in order to do that he must have two qualities of mind. He must have breadth of outlook, so that he can command not only a limited situation, but a very extended one, not only a certain set of conditions, but very many sets of conditions. A man who has charge of, or who is at the head of a large manufacturing business today, must have sufficient breadth of view so that he can not only understand what is going on in his factory, not only have some knowledge of the processes which must be carried on, and carried on properly, in

order that his business may be successful, but he must know something of raw material, and where it is to be found; he must know something of the machinery and other appliances which are used in his manufactory; he must know something of the conditions of the market in those parts of the world which his goods are to reach, in order that he may meet those needs, in order that he may anticipate them, in order that he may know what demand it is possible for him to produce in certain places. For I apprehend that if we content ourselves with meeting the demand that exists, we shall not any of us get very far. We must know what demand we can create by the show of our goods in new fields which they have not yet entered. And it is necessary also that our business man of today should have a very powerful imagination, in order that he may realize the meaning and the results of the things which he is doing. We speak of imagination as the quality of the poet, and the preacher, possibly of the historian; but I believe that imagination is even more than that the quality of the business man, especially the business man who is full of enterprise which is extended and various.

What I have enumerated seems to be possibly, at first sight, a rather exhausting, a rather extended list of requirements, and yet I am sure that every one of you recognizes that those are just the requirements of success, not only in your business but in any kind of business which is carried on under the conditions of our modern commercial and industrial life.

That is the kind of man that the college must somehow or other manage to create; the man who has control of his powers, who has ability to apply them with concentration to a definite purpose, who has ability to use other men, who has quickness and accuracy of judgment, who has a large outlook, and who has a very vivid and correct imagination. How are we to set about that? Isn't it by a carefully chosen and not too extended curriculum? Is it wise to attempt to teach the young man in college the things that he is going to use in business? Isn't it wiser to confine ourselves to the attempt to

develop the man and leave him to learn his business after we get through with him? Isn't it better to build the machine, and let life set the machine at work? That seems to me to be the thing that we have to do, and there comes in the importance of what is some times neglected, and some times nowadays decried as the "old-fashioned" college of letters, as if the old-fashioned college of letters were absolutely out of date, as if it must give way to the technical school, or to something which is going to be a kind of glorified commercial college. I certainly should be very sorry to speak in deprecation of the professional school, because a professional school is one of the successful departments of my own college, yet it seems to me the technically trained man, the man who is merely an engineer is somewhat at a disadvantage, because it seems to me that the man who is merely a technical man, while he may go a long way in the administration of business, is not trained rightly, and is not sufficiently possessed of those qualities I have tried to enumerate for him to be successful in the administration of large business affairs. You want a technical man for the head of a department, but when you want a man who is going to have general charge of a business which has many departments, you want something more than a technical man.

Now, I know that a great many men get these qualities entirely outside of the university, and I should be the last man to stand in this presence and say that the university is the only place where a man could get them. But my problem is simpler than that. It is to show that he can get the qualifications in the university if he has the right material in him, and that it is the business of the university to develop that material with a view to the development of the man rather than with a view to the filling of his head with a certain amount of definite information, which may seem to him what he is going to need when he gets out into the world. I venture to say, old-fashioned as it may seem, that the nowadays greatly neglected study of the classics has a very important place in such kind of mental training as I have indicated. I know it is not now fashionable to say so.

I know we are told that we need more practical things, that we are told the study of modern language will give a man a more useable instrument and the same training which he will get from a study of the classics. I venture to take exception to that statement for this reason: It is true that the study of modern languages will give a man a more useable instrument, but it is not true that it will give him the same degree of mental training because, when we are studying a modern language we are in the thought of the present day. The Frenchman, the German, the Spaniard, the Italian and the Englishman are all living the life of the twentieth century, they are caught up in the intellectual currents which are sweeping them all along together, and the intellectual life of the twentieth century is the same throughout the civilized world, however different the verbal forms in which that intellectuality may find expression; but the intellectual life of Greece and Rome were very much different, their thoughts were not our thoughts, their ways were not our ways, their life was not our life, and if we are to learn their language, we have a much larger task on our hands than if we are to learn French and German, a task that requires more abstraction, a task that requires a very much greater mental effort than is involved in the other. It is not possible for a man to put forth those great mental efforts without the result being an increased mental power, any more than it is possible for him to put forth physical efforts without the result of increased physical power. So I believe we are wrong in despising the study of the classics as the preparation of an active life today, for the reasons that in those studies, properly pursued, are to be found the fibre of mind, the intellectual power, which are to enable a man to grapple with whatever problem may be presented to him, as distinguished from the particular power or skill which enables him to grasp a technical set of problems and leaves him practically helpless in the face of others.

I believe too that in our preparation of young men for business, we educators have something to learn from the technical schools. I am going to give you a little bit of educational

heresy, particularly a heresy within the shadow of Harvard College. I am willing to say bluntly that I do not believe in the elective system. [Applause.] And the reason why I do not believe in the elective system is because I do not believe it is the right way to give a young man the mental powers that he must have if he is going to be the kind of man you and I want to see the universities turn out, you because you need them in your business, and I, because I want to fit them for your business. The technical schools are not elective. Their courses are pretty closely defined, and if a man is to be trained for an engineer, he knows he must do what the engineering school sets before him, just the same as when he gets out into the field he must solve the problems which lie before him.

Let me say, for illustration, that he rises to be the chief engineer of a new line of railroad, the new line we hope will be built some time to give New England an independent connection with the west. [Applause.] When he undertakes that job, he has got to solve every problem which that job presents to him, or else he is not going to be of any particular use. He has not only to build the bridges, but he has to cut the tunnels, he has to look out for the quicksands, he has to solve every problem that is presented, and there is no choice in the matter at all, excepting that he may within limits lay out his lines to avoid expensive difficulties and unnecessarily long detours. We have gone rather daft in my opinion over a theory of education which unfits a man for doing just that thing, which sets him in college and says to him, "The college offers these hundreds of courses, now follow the line of your least resistance, take out of those courses what you want, choose what you like, and in the choosing get your education." It seems to me that is precisely what we do not want today, because it seems to me that that is not fitting a man for business, but unfitting him for business, if any educational system could unfit him for business. It is training him in loose habits, in unbusinesslike habits, it is undermining his power of concentration and standing in the way of development of that stern

and rigorous self-control, which is what he most needs for the successful performance of tasks which lie before him. I do not take this position because I believe there is so great an inequality in the value of studies themselves, but because I believe there is the greatest possible value in holding a young man to the performance of set tasks, and in training him to do the day's work, giving him that habit of readiness for whatever may come up, that willingness to tackle the hard things, and that determination born of necessity to conquer them, which are necessary to the success of the business man.

I believe, gentlemen, that there is a great field for universities in the preparation of men for business. I think we are going to realize our task in that regard, and I have come here tonight to tell you how the task measures up, as I look at it, and to tell you how I, at any rate, think that task ought to be tackled. [Applause.]

President HARTSHORNE. On some informal occasion JOHN LONDON MACADAM was dining in company with Sir WALTER SCOTT when he offered this toast; "To Sir WALTER, the colossus of literature." Immediately Sir WALTER replied; "To JOHN LONDON MACADAM, the colossus of roads." [Applause.] The wonders of the modern world are not confined to seven, for surely our industrial development, our manufacturing achievements and the merchandizing of its products are certainly among such great wonders, and when we find a man who is a master of each, a manufacturer as well as a merchant, we may well consider that he belongs to the colossal class. Such a man we have with us tonight, a member of this Association, the president of the National Association of Wool Manufacturers, one who is well known to you all. I have the great pleasure of presenting Mr. WILLIAM WHITMAN.

ADDRESS OF MR. WILLIAM WHITMAN.

Mr. President and Gentlemen of The National Association of Cotton Manufacturers :

I feel abashed after such an introduction, Mr. President, as you have given me.

It was with great diffidence that I accepted the invitation to be your guest this evening and deliver an address. I distrusted my ability under existing conditions to speak words that would be either useful, helpful, or encouraging. I feel equally diffident now, but obligations to this Association, with which my business is closely affiliated, and of which I have been a member for many years, the desire to meet so large a number of your members, and my personal friendship with many of them, inspire me with courage to express very briefly some thoughts regarding existing trade conditions and relations which affect us all alike.

The subject of my address is:

THE INVIOLABILITY OF MERCANTILE OBLIGATIONS.

Unquestionably the present depressed and disrupted condition of business and industry in this country is to be ascribed to the recent financial panic. In my judgment the disastrous effects of that panic are more widespread and lasting than those resulting from any other panic during the last half century. They would have been incalculably more ruinous had not industrial, agricultural and commercial conditions for a long time previous been unusually healthy and the country more prosperous than ever before in its history. Because of these there have been comparatively few failures.

While the process of restoration appears to be slow, there is every reason to cherish the hope that normal conditions will prevail at a comparatively early day. Money which was almost unobtainable for several months is now offered at lower rates of interest than for many years. Stocks of merchandise are

depleted. The shrinkage of values has apparently ceased. This shrinkage has been so great — greater than I have ever experienced — that prices now ruling are so low as to offer extraordinary inducements to buyers. Purchases can be made with greater safely as to change of value at the prices of to-day than they could have been made at any time for several years. It seems to be a good time to buy. I think it is always good business to buy when prices are abnormally low. I do not look for cheaper cotton or wool, which are the raw materials we are more especially interested in. Once buying sets in, prices cannot but advance. Confidence is being gradually restored. When we consider the long period of depression through which we have passed, with its attendant results, in connection with the high promise that our agricultural products will afford a large surplus for shipment to foreign countries, how can we held being inspired with confidence in the early return of prosperity to our various industries? There are more people to be fed and clothed to-day than at any previous period. There is not only an increase in the population, but there will be an increase in the wants, if not the needs, of our people. Time will accentuate such wants. As an indication of the confidence of myself and associates in an early restoration of business activity, let me say that we are now erecting and will soon have in operation a new cotton spinning mill that will cost $1,500,000.

By newspapers, magazine articles, public addressse, expressions of commercial organizations and sermons from the pulpit we have been told of the very many causes for the late panic, of the many lessons supposed to be taught by it, and of many remedial measures alleged to be necessary to prevent future panics. Most of these will soon be forgotten. It is not my present purpose either to discuss or even enumerate them. Permit me, however, in availing myself of the opportunity now afforded me to speak very briefly of but one of the chief causes of panics and business disorders, and to impress upon you the vital importance of advocating, enforcing and acting upon the fundamental principle that mercantile obligations should be held

inviolable. The time is opportunity for such action. It is in harmony with the great moral awakening of the entire country with which his excellency, Governor HUGHES, is so prominently identified.

I do not question the business honor of our people, but recent experience has forced me to the conclusion that business methods are loose, if not vicious, and that too large a proportion of business men do not recognize the binding nature of the obligations imposed by contracts. It seems to me that this is especially so in the busiuess in which we are mutually engaged, and I think that it should not be so. In my opinion, a true regard for the inviolability of mercantile obligations furnishes the best safeguard against unnaturally rapid expansion of credit or of business. If that regard existed, financial institutions would be more careful in making engagements for the loaning of money, and surely one of the greatest losses to the business community during the recent panic resulted from the sudden withdrawal of bank accommodation. Commission houses would not arbitrarily withhold customary advances upon the merchandise of their consignors. Nor would they easily permit returns and cancellations which are so detrimental to the interests of consignors.

When our merchandise is disposed of we should have the assurance that the sales are bona fide and that payment can be depended upon. If every man who sold mercandise would insist that the buyer live up to the terms of the sale; if buyers would feel that they must not buy beyond the needs of their business or beyong their capacity for paying; if both buyers and sellers would recognize their mutual obligations to the full extent, and neither one would expect the other to bear any part of his losses or burdens, it would surely lead to more conservative and sounder business transactions.

The maintenance of a high standard of business honor depends upon a thorough understanding of the character, scope and binding nature of business obligations. It behooves every man to insist that his business transactions shall be based upon the faithful performance of all contracts. Most business contro-

versies arise from loose, if not improper ways in which contracts are made. Such contracts have the effect of lowering the regard in which obligations should be held. Honor is the foundation of credit. Character and honor are synonymous. Character has been described as the power to make talent trusted. Wealth or property without honor is an insecure basis for credit. Our country's vast volume of business, so immense that it cannot be comprehended in its entirety, nor conveyed to the mind by statistical exhibits, has been built up by, and is now conducted upon, credit. A very large part of this immense business is transacted without written contracts, and a larger part under written but not legally binding contracts. The spirit, not the letter, of the contract is, after all, the essential thing. Business men must trust each other, and this trust or confidence is to be based upon the character. We must look rather to the man who makes the contract than to the contract itself.

We are often told that the standard of business honor is not so high as it used to be, but years of experience convince me that this is not true. No one can consistently deny the existence of the evils to which I have referred; nor of many trade abuses, fraudulent transactions, prevalence of speculative mania, unreasoning haste to get rich, and the overestimation of wealth among life's blessings. But all these and kindred evils have ever existed and probably will exist in a greater or less degree to the end of time.

The fundamental principles of permanently successful business, however, are the same now as yesterday and will remain the same forever. Business based on wrong principles cannot be permanently successful. Fortunately the results of wrongdoing are in themselves the preventatives of wrongdoing. Failure to live up to the terms of a contract is only excusable on account of inability to perform, and inability is, after all, only a partial excuse, for obligations should not be incurred without reasonable certainty of ability to meet them. Any attempt to evade the terms of a contract on a technicality is to be condemned. The magnitude of our business is so great that it

could not be transacted if contracts had to be surrounded with every possible legal safeguard. The oral should be equally as binding as the written contract, but the latter is needed to prevent misunderstanding of terms or conditions, as well as lapses of memory. Sellers of merchandise only too frequently refrain from demanding what is justly due them from buyers for fear of losing what they term the buyer's patronage or good will, but neither buyer nor seller can afford to do business with those who either cannot or will not meet their obligations.

It has been said that competition is the life of trade. While this may be true, there is a kind of competition that is ruinous to trade. The records of the past are filled with business wrecks resulting from unfair competition. Such competition as comes from underselling the products of one's own or others' labor is destructive. Underselling is to be condemned, not approved. No man should be excused from the performance of a contract because of a loss arising from changed market conditions. The burdens of mistakes or errors of judgment should be borne by those who make them. Burdens of the community can be more widely and evenly distributed by each man accepting and bearing his own burdens. The man who cheerfully and manfully bears his own burdens cannot but command the respect of his fellows. Generosity, liberality or philanthropy cannot honorably be indulged in at the expense of others. The first obligation of the debtor is to pay his own debts rather than to release from payment the debts that may be due to him. One should be just before he is generous. He who would intentionally evade obligations is not entitled to credit. I am unable to distinguish between the obligation expressed in a note and the obligation of a maturing debt on open account. There should be no preference in payment of the obligations in ordinary business transactions.

During the trying period through which we have been passing we have been common sufferers from trade evils. As you know, there have been demands for cancellation of orders, refusals to accept shipments, requests for delayed deliveries,

extension of payments and postponement of payments. There have also been non-payments and attempted evasions of contracts of all kinds on purely technical grounds. Recognition of such demands and requests and the granting of them would cause widespread mercantile disaster and disturb the foundations of credit. Such organizations as yours have it within their power to do much towards remedying trade abuses to which I have referred. They can also do much towards cultivating and maintaining a high standard of mercantile honor among their members. Those who insist that business obligations shall be fully met may be regarded with disfavor by delinquents, but they are entitled to the hearty support of their associates and all good men. The delinquent only should be regarded with disfavor.

For our mutual protection we should unite and stand back to back for sound business principles. They will insure greater safety and preserve honor and credit, and I take it that it is the ambition of the larger part of those engaged in business to uphold the honor and the credit of American business men and to give courage and support to those who insist upon the enforcement of these principles. The maintenance of a high standard of mercantile honor is essential to high credit, and our material prosperity is largely dependent upon both. While insisting upon the inviolability of mercantile obligations, we are forced to admit that there are such things as accidents, misfortunes, losses and failures which bring to grief honest, capable, and well-meaning men. These have claims upon us for assistance which deserve and in most cases cheerfully receive recognition. The views I have previously expressed are not intended to warrant a declination to extend such accomodations as properly belong to the amenities of business relations.

At the close of my business career I would like to have it said of me that I had never attempted to evade a just obligation or failed to meet one, even though such an expression should be coupled with the assertion that I had insistent upon the fulfillment of obligations to me.

President HARTSHORNE. The highest development of civilization on its commercial side rests upon the foundation of faith of man in man. This faith must be that of the optimist who can at least see the doughnut if not the hole in it, rather than that of the carping pessimist who may see the hole but never the doughnut. It is to the wise man who can see and point out both, that the public turns with confidence when he rises to speak, either by word of mouth or through the press. Such a man we have with us tonight, a successful banker, a man whose wisdom in financial matters has merited not only the confidence of his fellow men, but notably that of the Federal Government. I have great pleasure in introducing to you HENRY CLEWS, L.L.D. of New York City. (Applause.)

THE FINANCIAL AND TRADE SITUATION AND PROSPECTS.

HENRY CLEWS, LL. D., New York City.

In familiarizing myself with the history, scope and objects of the distinguished organization I have the honor to address — The National Association of Cotton Manufacturers — I was impressed by the vast extent and importance of the interests it represents through its membership, which covers not only New England but the whole manufacturing world of the United States, to say nothing of foreign countries in which it has a notable representation.

Such an organization is obviously capable of exerting great and lasting power for good in the improvement and development of the cotton manufacturing industry in this country, and incidentally it cannot fail to benefit all the manufacturing interests, for their are ties, visible and invisible, that bind them all together in a bond of mutual sympathy.

How immense these interests are is almost beyond computation; but we may form some idea of them from the fact that the capital stock of the textile mills, print works and bleacheries represented by your association's own members alone, aggregates no less than $334,500,000, without counting their surplus.

Your statistics further tell us that in these mills are 17,157,637 spindles, 1,472 sets of woolen and worsted cards, 5,849 knitting machines and 67 printing machines. These figures are eloquently suggestive of the country's manufacturing enterprise and skill, which have kept pace with its rapid growth, and the progress of mechanical science.

Beyond all this, you have $400,075,000 more capital in the affiliated manufacturing industries of cotton cloth, cotton textile machinery, mill supplies and the like, represented by your associate members. This indeed is a grand exhibit.

So your Association is the representative of $734,586,000 of capital, a large item in the national wealth of the United States. But, great as it is, it will continue to grow with this great and ever-growing nation, and with it will come still further improvements in mechanical processes, methods and machinery, and a far wider foreign market for our manufactures, especially in the Orient and South America, where the British and the Germans have dominated trade in the past.

This Association in its work for the advancement of cotton manufacturing interests, and particularly in the promotion of their commercial relations, and whatever relates to improvements in manufacture, is a valuable ally of the motive power that turns the wheels and runs the machinery of the mills; and I congratulate you on being united for a purpose so conductive to both the prosperity of a great manufacturing interest and the national welfare.

I will now turn to the main subject, the financial and trade situation, present and prospective, in which I find much that is encouraging and favorable to a general betterment of conditions from this time forward. Hear! Hear!

With regard to business conditions and prospects, the general sentiment of both Wall street and the rest of the country is optimistic, and to this may be attributed the extensive recovery of the stock market that has already taken place, since the crisis that began in October. Although the dealings in stocks have been very largely professional, the improvement reflects the confidence in the situation of the rich Wall street men who have led the movement, and confidence, like distrust, is contagious.

The absence of any considerable buying by the outside public has been conspicuous, but so also, since the end of 1907, has been forced or voluntary liquidation. Hence, there being no pressure to sell actual stock, it was easy for the powerful bull

party at work to advance prices against the short interest, which was very large; and the bears were driven to cover their contracts at a heavy sacrifice of their previous paper profits. But, like the poor, the bears are always with us, and their expressed views as to trade conditions and prospects are, of course, as pessimistic as those of the majority are the reverse. But the majority rule, and Wall street never fails to discount the future. It is the great financial barometer of the United States.

Leaving sentiment aside, there is ample scope for differences of opinion as to the exact situation and the future, so conflicting are the reports that come to us. In some sections, and some industries, very different conditions are reported than those that prevail elsewhere, and bankers, merchants and manufacturers in the same towns disagree as to things as they are.

This shows that we are in that uncertain transition period which always follows panic; and how long it will last, is the problem that business men all over the country are now trying to solve. Meanwhile the rise in stocks, which has been encouraged by the banking interest largely for the sake of its influence in promoting confidence among the people of all classes, may fairly be looked upon as the precursor of substantial improvement in general business.

Yet, however much we may hope for quick recovery from the effects of the crisis, we should always look unfavorable facts squarely in the face, for self-deception is the worst kind of folly. We must consider the worst, as well as the best, features of the situation, in order to gauge it correctly; and the reduction of ten per cent. in the wages of cotton mill operatives in New England, and the working of many cotton, woolen and other mills on part time only, and the shutting down of others, show how much the manufacturing industry there, as well as elsewhere, has been affected by the severe ordeal we have passed through.

But, so far as the banking institutions were concerned, Boston enjoyed a larger degree of immunity from trouble during the crisis, than any other city, a fact that bears testimony to their soundness and conservatism. Boston may, therefore, well pride

herself on this memorable circumstance, the result of good banking and good business methods. She had, fortunately, no speculative capitalists with chains of important banks under their control, as New York had.

The crisis accomplished one good thing, and that was the sweeping away of this unsound banking, which had become a menace not only to New York, but to the whole nation.

The best banking authorities believe that actual business improvement is already making headway, although there is no uniformity in it, the recovery in some places, and some lines of business, being decided, while in others it is barely visible. Thus the Southwest, and its great distributing center, St. Louis, report a larger degree of betterment than any other section, while Chicago, like the Eastern and Middle States, reports comparatively little.

In the present stage of recuperation, the wage problem is forcing itself more and more upon public attention, and especially upon that of mill owners and the railway companies. The urgent necessity the railways are under of reducing them, to offset reduced earnings, is met by the unwillingness, or refusal, of the men to have them reduced. They have been encouraged in this situation by President ROOSEVELT'S action, and now the labor leaders are urging Congress to legislate in support of their position. But capital has its rights as well as labor.

The railway companies, as an alternative to reducing wages, have proposed an increase in freight rates, but shippers are up in arms against this, particularly manufacturers; and the authorities of the states, as well as the Interstate Commerce Commission, signified their opposition to it. The railways, meanwhile, have kept pace, as far as practicable, with the contraction of traffic, by discharging large numbers of their men. In this way they have materially reduced their expenses, while they report increased efficiency by the labor still employed, every man in these times being anxious to hold his place by doing good work.

That is to say, jobs being now scarce, men want to keep their

jobs, instead of being "laid off," as the phrase is. This of itself is a wholesome effect of hard times.

The labor problem is one of peculiar difficulty, and substantial, permanent improvement in trade and securities will not be seen until there has been a complete re-adjustment of commodity prices and wages in accordance with the altered conditions. To insure a steady word for labor and a fair profit for employers why would it not be wisdom for the Union labor leaders to agree to a contract, to last for four months only, consenting to a reduction of 20 per cent. in wages if the times warrant it.

Re-adjustment is a harmonizing process, and harmony promotes recovery and the full development of our powers and resources. This is what the business situation imperatively calls for now, and all business men should do their best to foster it, and so work together as a unit, for in unity there is strength. We have an example of it in these United States.

The cotton goods industry in New England has, I know, been much more severely depressed by the crisis than was, at first thought possible; but fortunately, the losses sustained will be the more easily borne because of the large profits of previous years. Notwithstanding the cuts made in standard goods, the demand for them is still abnormally light, and hence stocks are accummulating, in the face of the heavy decrease in production.

No wonder, therefore, that those most intimately concerned are more or less at sea as to how long this depression will continue, and what the results will be. They see certain grades of goods that were selling at 8⅜ cents a yard just before the panic now being offered at 5½ cents, and this is an object lesson that tends to make even the most optimistic of them a trifle blue for the time being. But this is precisely the time when courage and confidence in the situation are most needed. I give you all credit, however, for being equal to the occasion.

With eighty-five millions of our own people to clothe — to say nothing of the rest of mankind — manufactured cotton products will before long be in demand again at rising prices, for civilization demands clothes in hot weather as well as cold.

Meanwhile, endurance is called for, and will doubtless not be found wanting, except where special circumstances impose limits to it, and we all know that patience is a virtue.

Recovery to normal conditions will, of course, be gradual, and it is better that it should be so, to ensure permanence. In the meantime, it will be a relief to the dry goods trade when sales are no longer extensively made by cutting under quoted prices more or less sharply.

The bold, and even aggressive, action of the American Federation of Labor in going to Washington and making demands upon Congress, and criticising not only the laws but the decisions of the Supreme Court of the United States, puts a new and serious face on the old contest between labor and capital. It arouses some apprehension as to the lengths to which labor will go, and how far its political influence may enable it to accomplish its purposes. Politicians are ever ready to show subserviency to labor, merely for the purpose of gaining votes for themselves.

We all want to see justice done to labor, but we also want to guard against injustice being done to capital by labor, and labor's resistance to a reduction of wages to correspond in some degree with the decline in the earnings and profits of those employing it, is a practical injustice to all those outside the ranks of organized labor.

The re-adjustment of wages to existing conditions is, therefore, of the first importance and should be first to receive serious consideration, with a view to harmonizing both sides, and a prompt settlement. Half a loaf is better than no bread, for both labor and capital, and it is not to the interest of either to kill the goose that lays the golden egg. Their interests are mutual, but labor is posing as if they were antagonistic. It has often done this before, but never more conspicuously than now.

With respect to our foreign market for cotton goods, there is plenty of room to widen it, but our exports of these, in competition with England, Germany and other countries, are more or less checked by the high price of labor here, and its compara-

tively low price there. Hence we ought constantly to endeavor to overcome this disadvantage by keeping ahead of the rest of the world in labor saving devices, and improvements in machinery and manufactures. We should try to surpass all Europe in the quality, as well as the cheapness, of our goods.

As we are the most inventive of all nations, and the quickest to adapt ourselves to new or altered conditions, we shall doubtless find this feasible, if not an easy task, whereas England, our greatest competitor in manufacturing, is proverbially slow in changing machinery.

I once asked Mr. ANDREW CARNEGIE what was the mainspring of his phenomenal success as a manufacturer of iron and steel, and he replied:

"I always kept foremost in making improvements in my machinery and methods of manufacture. Whenever a new invention that I could use was patented, I secured it at any cost, and so kept in advance of all my competitors.

"At one time I had two million dollars worth of new machinery that I was about to install, but a man came to me with an improvement in it that he had just patented, and I bought his patent and adopted it. In doing this, I had to cast aside, as old material, the two million dollars worth of new machinery. But the improvement recompensed me many times over for what I had sacrificed to make the change."

It is in promoting improvements in manufacturing processes and machinery that this Association, apart from its general utility, can be of great and permanent value to the cotton mill industry and kindred manufacturing enterprises. Ready adaptability of means to ends is as important in manufacturing cotton sheetings, and the other products of the loom, as in every other business and everything else.

I remember that in conversation with Admiral Sir CHARLES BERESFORD of the British navy, when he was visiting New York, he told me of an instance of American adaptability to circumstances, that he noticed while in China. The Chinese had been long complaining of the want of sufficient width in a certain

grade of British cotton fabrics that they were using and they had asked the English agents from time to time if they would increase the width. But nothing came of their expostulations and requests as the agents, after writing home, told them the Manchester manufacturers said they would have to alter their machinery in order to give them the desired width, and this could not be done.

But the agent of a large American dry goods house, with extensive cotton mill interests, arrived at Shanghai, and hearing the complaint of the Chinese, he said, "Give me your order and you can have whatever width you want," and he got the order. Sir CHARLES added: "So, you see, you people are smart and give them what they want; besides, you make your cotton goods heavier than we do and the Chinese like them better because they wear longer, for when the Chinese put on such clothes they never come off until they rot off." [Laughter.] Here was an instance of ready adaptability to the occasion and market needs by an American which the English lacked. [Laughter.]

An illustration of the importance of scientific investigation with a view to the discovery of new elements and processes in manufacturing, is found in silkine, a fabric closely resembling silk, which has come into popular use. It resulted from the discovery that the mulberry, and other trees on which silk worms feed, possess properties that could be extracted and utilized, to a certain extent, in the production of a silky fibrous material which in combination with fine Egyptian cotton, made a cloth so closely resembling silk as to be possibly mistaken except by experts, for the silk of the silk worm. Here theoretical and practical science were happily combined with mechanical skill to produce an entirely new material, and doubtless there are many similar opportunities awaiting discovery. This Association by stimulating such investigation in mechanical science may achieve even greater results than it anticipates.

The world's markets offer a most magnificent opportunity for the enterprise of American cotton manufacturers. We grow four-sixths of the world's crop of cotton but manufacture only

one-sixth. That is to say, we export three-fourths of the cotton we grow, leaving England and Germany to turn the fibre into yarns and fabrics for other countries in all parts of the world. A much larger share of this foreign trade ought by right to come to the United States, for the foreign market offers a field vastly larger and quite as profitable as the domestic field, if the extraordinary profits of Lancashire spinners during the past few years are to be taken as an index.

Last year Great Britain exported cotton goods valued at $500,000,000, while our exports of cotton manufacturers were offered at only $26,000,000. During this same period Great Britain exported 6,298,000,000 yards of piece goods valued at $400,000,000; our exports meanwhile being only 216,000,000 yards at $15,000,000. Here, then, is a field for our best ambitions and skill, We cannot forever endure the sight of seeing other nations manipulating our raw product at enormous profits a goodly portion of which should remain for distribution on this side of the Atlantic.

There is one respect in which the New England cotton industry much impresses an outsider. Your industry, I am glad to say, is, and always has been, remarkably free from the evils of promotion and speculative enterprise. Furthermore, it has most fortunately not been inoculated with the fever for trusts and consolidation; although I happen to know that such projects have from time to time been presented to your consideration. Perhaps your refusals to entertain such propositions thus far have been due to conditions peculiar to the industry; yet I venture to hope that it has been not a little due to the strong spirit of individualism which is one of the best characteristics of the New Englander; a characteristic which I trust will be cherished for generations to come because it is a most wholesome and necessary check upon the paternalistic tendencies of the day. One beneficial result of this policy is that the cotton industry is adapting itself to the new conditions following the panic with much less friction than in other industry. You have lowered prices, curtailed production and diminished costs in order to

stimulate a revival of consumption in a manner that promises to make you among the first in completing the process of readjustment. When recovery begins the cotton trade ought to be among the first to feel reviving influences. While other industries have been using or misusing their newly acquired powers of combination to resist natural tendencies, or to squeeze out dividends upon grossly watered stocks, you have squarely faced the new conditions and trimmed your sails accordingly. I have no doubt, therefore, that with your mills honestly capitalized you will soon be going along safely and comfortably in smoother waters when the trusts will still be struggling against adverse conditions simply made worse by foolish resistance to economic laws.

The most encouraging feature of our business situation now is the prospect of an unusually large wheat crop, winter wheat being in extra fine condition, and spring wheat having been planted under the most favorable conditions, owing to the season for farm work being three weeks earlier this year than last. The planting of other crops has also been facilitated by good weather and altogether the agricultural outlook, at this date, has very rarely been so promising of bountiful results.

This is a great national blessing, for the foundation of our national wealth is our crops. Agriculture is indeed the great source of both our national and international strength. It was almost entirely from this resource that we were enabled, from a merely nominal sum last August, to built up a foreign trade balance of 521 millions of dollars in the first eight months of this fiscal year and the large preponderence of our exports over our imports still continues and will make the balance in our favor at the end of the year one of unexampled magnitude

This curtailment of our imports, especially of luxuries, has made the shoe pinch in Europe, for we had been Europe's best foreign customer. But, naturally extravagant as we are as a people, we can economize with as much ease, celerity and determination as we can spend, when the necessity to do so arises. So we are at present economizing on a grand scale and with great success.

We have only to consider our unlimited sources of national wealth, however, to see that the prospect before us is one that should inspire absolute confidence in the gradual return of prosperity in all directions. Let us bear in mind that our agricultural products yielded us last year, as the returns of the Department of Agriculture show $7,400,000,000.

Mining and manufacturing were the next largest sources of our national wealth. The metals mined yielded $3,000,000,000 and this metal product was converted by manufacturing into materials that had a market value of fifteen thousand millions of dollars. Thus the agricultural products, metals mined and metals manufactured in the year had a value of $25,400,000,000. We may, therefore, well and honestly say that this is a great country. "Long life to it!" as an enthusiastic Irishman was once heard to exclaim. "By jabers, it can't be beat!"

The market for raw cotton, has of course, been handicapped by the depression in the cotton industry, and the efforts of the Southern planters to advance the price of the staple very materially by holding it back instead of marketing it, have failed, as they deserved to fail. Cotton is now lower than it was during the crisis, and about as low as at any time in this crop year, being 300 points, or three cents, a pound below the season's top notch. But cotton is still king in the factories.

This decline is equivalent to fifteen dollars per bale, or a hundred and eighty million dollars on a crop of twelve million bales. So spinners and spot buyers in general have not for two years had so good a chance to purchase for summer and autumn delivery, and advantageously cover their season's requirements as they had last month and this. But spinners have taken more than a million bales less of this season's crop since the first of September last than in the same time in the previous year.

The Census Bureau in its final report for the season tells us the total crop ginned up to the first of March last was 11,261,163 bales, including "linters"; and it estimates that 127,646 bales remained unginned on March 1. Allowing for the usual underestimating of the cotton ginned in the reports to the govern-

ment, it follows, from the figures, that the spinnable cotton from the last season's crop will aggregate no more than 11,500,000 bales. This is with the average net weight of a bale 501½ pounds.

The statistical or technical position of cotton is therefore bullish, notwithstanding the very large falling off in consumption and the requirements of spinners, this year, both here and in Europe, as the indications are that there will not be a very heavy or unmanageable load of cotton to be carried over into the new crop year, which begins on the first of September.

One very hopeful sign of the times is the check that has been given to radical State legislation concerning railway corporations by the Supreme Court of the United States, declaring the rate laws of Minnesota and North Carolina in certain respects unconstitutional. The decision practically denies the right of a State to enact and enforce rate laws against interstate railways. This takes the wind out of the sails of a good many Western and Southern political agitators, and makes the State Courts more definitely than ever subservient to the Federal Courts. The clash as to jurisdiction between the two courts which we witnessed in the South last year is therefore not likely to recur.

The decision was based mainly upon the unreasonable penalties prescribed by the North Carolina and Minnesota statutes, but it sustains beyond all question the contention of the railway companies, which are now held to be at liberty to refuse to obey any State law reducing rates, upon their making affidavit that it would reduce their earnings to an unreasonable extent. Upon such an affidavit a judge of a United States Circuit Court can order a suspension of the operation of the law until the law can be shown in court to be reasonable.

This is a protecting bulwark against radical and confiscatory State legislation, resulting from the inflammatory appeals of demagogues. By protecting the railways it protects investors, and adds to the security of railway property, which, in turn, strengthens confidence in that property, and confidence is what is most necessary to recuperation. Let us therefore help to increase it.

It is the desire to promote confidence, and clarify the business situation, that has inspired the recent utterances of President ROOSEVELT, and dictated the course of the Federal law department. This is commendable and has had a good effect.

The most spectacular event of the crisis, and its most sensational starting point, in New York, was the failure of the Knickerbocker Trust Company, under a wild rush to withdraw its deposits on the 22nd of October, 1907, and the subsequent suicide of CHARLES T. BARNEY, its president; and the most satisfactory event in its later career was its resumption of business on the 26th of March, 1908, after many trials and tribulations. On that day, too, it received $1,500,000 of deposits more than it paid out, a remarkable contrast to the heavy run before the suspension. This, and the almost simultaneous payment in full of the depositors of the Oriental Bank, a New York State institution, were reassuring influences that did much in helping to pave the way to general recovery, and stimulate the rise in the stock market, which of itself had a good moral, if not material, effect upon the business situation.

It was not until the fourth day after the Knickerbocker's suspension, namely, on Saturday, the 26th of October, that the New York Clearing House Committee decided to issue Clearing House certificates to the banks in the Association needing them, to pay their Clearing House balances. Then their issue, against satisfactory collaterals deposited with the Clearing House, began at once. This was the signal for every other Clearing House in the country to do likewise simultaneously.

On the same day the detailed weekly bank statements were suspended, and these were not resumed until the 8th of February, 1908. Meanwhile, a hundred millions of the Clearing House certificates had been issued and redeemed except some that were held by the National Bank of North America, the Mechanics and Traders Bank, the Bank of New Amsterdam, and the Oriental Bank, which had all failed, but these were all redeemed before the end of March.

It was in the third week of November that the issue of

Clearing House certificates reached its maximum. But the banks had reached their largest deficit in reserve in the first week of November, when it rose to $54,100,000, a prodigious amount, of which the public was in ignorance.

In Boston at the same time your banks had taken out $11,995,000 of their own Clearing House certificates, but this total was never increased. After that the banking situation all over the country was slowly on the mend, but owing to the partial suspension of currency payments by the banks caused by runs and hoarding, inspired by the use of Clearing House certificates, currency and gold commanded a premium in New York ranging from one to five per cent. This premium was current from the time the certificates were first issued till the end of December, 1907. The hoarding of money was, meanwhile, enormous. After that the premium became suddenly a thing of the past, and hoarded money was rapidly deposited with the banks.

It is noteworthy that in the panic of 1873, the New York Clearing House issued only $26,565,000 of certificates, and in the panic of 1893 only $41,690,000. But these figures merely show how very much smaller New York's banking capital, deposits and loans were in those years than they are now.

The throwing out of employment through the effects of the panic of large numbers of men, most of them of foreign birth, resulted in a larger exodus of steerage passengers to Europe than was ever before known, these aggregating 114,078 in the first two months of 1908, while only 50,601 immigrants arrived here during those months. The outward rush commenced in November and it still continues with little abatement. But as a safety valve for unemployed labor it is perhaps to be welcomed for the time being, as it reduces the ranks of the unemployed and when the labor of these aliens is again in demand they will return as fast as they went. They know on which side their bread is buttered.

Immigration is, however, no longer as necessary to this country as it was in pioneer times. Our aim now should be to

keep out undesirable immigrants, particularly anarchists, Black Hand Italians and Armenians, and rabid socialists who come here to make trouble, and preach doctrines of equality and confiscation, entirely inimical to American institutions and national as well as individual progress.

I now come to the markets for stocks, bonds and speculative commodities, and the recent indiscriminate attack upon them by Mr. BRYAN and others, both in and out of Congress, as hotbeds of what they call gambling.

As one of the oldest members of the New York Stock Exchange, I am the sixth oldest, I think now I can from my long experience, testify to the integrity and high character of its membership, and the strict discipline of that Association over those composing it. Any breach of its rules, any deviation from the line of fair dealing, or anything prejudicial to its interests is promptly investigated and as promptly punished, when proved to the satisfaction of the Governing Committee, by fine, suspension, or expulsion. But it is very rare for a member to be either charged with or found guilty of chicanery of any kind.

It is therefore unjust and outrageous for Mr. BRYAN and others who have denounced the New York Stock Exchange to call it a gambling arena and its members gamblers. They are brokers in a free market, a market open to all the world, and they are ready to receive and execute orders from all the world, and whether or not those orders are for investment or speculative account, it is not for them to enquire. Still less is it for them to discriminate against speculation, when speculative far more than investment dealings are the life of every stock exchange in the world. A stock exchange to have any value must be a free market.

Speculation in stocks is no more gambling than speculation in real estate, or merchandise, although different in degree, but there may be excesses in speculation as in everything else. The stock exchange as a body should not however be held responsible for the excesses of individual speculators, or for the dishonesty of men who embezzle in order to get money for the

purpose of speculating. Gas should not be blamed for causing the death of a man who deliberately locks his room door, shuts his windows tight and turns on the gas to die.

Those who know Wall street well, as I do, know how false a view of it Mr. BRYAN and others, including certain members of Congress, have given to the public. If they really had known Wall street well, and had any conscience, they would not have said what they did say. They have misrepresented it grossly and unjustifiably, and in their moralizings upon it they have not reasoned, but ranted.

Some of them have even advocated the entire elimination of the stock exchange. They would thus invite financial chaos and leave investors, the banks, insurance companies and all other corporate holders of stocks and bonds practically without a market for their securities in which to either buy or sell. This would be putting back the hands of the clock of progress with a vengeance. It would be going back to the wigwam and the canal boat, but of course it would never be tolerated and therefore be impossible.

Yet this slandering and mudslinging campaign by representatives of both the great political parties for political effect is none the less injurious and reprehensible because it can never have any substantial result, much less the destruction of Wall street. It is scandalous abuse of which we may have more before the November election, but it is already high time that it should stop in the interest of truth and justice and the public welfare.

These assailants of the New York stock exchange would also abolish all other stock exchanges and the Chicago Board of Trade, as well as all the other grain and provision exchanges, and all the cotton exchanges in the country that deal in futures. Perhaps they are not aware that the farmers and planters of the West and South derive or can derive great benefit from having a free market for "futures" open to them, for it enables them to sell their crops before they are harvested, if the prices are satisfactory and they want to make sure of them. This applies also to the Coffee Exchange and importers of coffee.

To drive dealings in "futures" from the Cotton Produce and other exchanges, would be to drive them to Canada and Liverpool and London and let the markets there make prices for us, instead of making them for ourselves, all of which shows the absurdity of this clamor against speculation in stocks and speculative commodities. Speculation is thus stigmatized as gambling with no more reason or justice than the inevitable risks of ordinary mercantile trade could be called gambling, for no one can engage in trade of any kind without taking risks.

Now that the storm of the crisis has passed away and the investigation and prosecutions that have taken place have laid bare the corporate evils that were rife among us, including railway rate rebating and various forms of looting and wholesale graft by controlling capitalists, we have come into a purer business atmosphere. Corrupt plundering and law breaking officers of banks and railway, insurance and other large corporations have, in many cases, been exposed and shown the error of their ways, and we have in consequence a higher business morality than we had before we passed through this ordeal of purification. In other words, the house cleaning we have had has done us good and this of itself is a compensation that can hardly be overrated in its future influence. Banks and trust companies and railways, insurance and other corporations have been freed from much unsound and dishonest management and also loose, grafting and speculative practices and we have in their place that higher moral tone which is safeguarded by greater publicity of accounts and more rigid official examinations under new and stricter laws than ever before.

Thus temptation to and chicanery and other corporate wrongdoing, and abuses, by those in control of corporations is largely reduced and this is important, for an old proverb tells us that opportunity makes the thief.

Good grounds for an optimistic view of the situation and the future you will all acknowledge can be found in our unequalled and immense natural resources and their uninterrupted development. These and the enterprise of our people and our free

institutions and popular government, which make us all sovereigns in our own right, are national blessings. They fortify our national life, and leave our splendid growth and powers of achievement unchecked; and our wonderful progress in the past will no doubt be eclipsed by our still greater and grander future with the United States of America the foremost nation in the world.

In all this progressive movement the cotton and other mill industries of New England, and the rest of the country, will share; and in this natural and legitimate expansion, gentlemen, you and your successors may look forward to, and find, the potentiality of wealth beyond the dreams of avarice, as ANDREW CARNEGIE did in Pittsburg.

From a great American object lesson as set by Mr. CARNEGIE, you should all derive a vast amount of encouragement and from hope that ever springs eternal in the human breast. [Applause.]

THIRD SESSION.

FRIDAY MORNING, APRIL 17, 1908.

The Association met in Huntington Hall at 10 A. M., President HARTSHORNE in the chair.

The PRESIDENT. The meeting will please come to order.

Mr. LOUIS SIMPSON. Mr. President, might I ask you to kindly allow me to make an explanation before the business of the meeting commences.

Last summer I was asked by our esteemed Secretary to write a paper on some subject that would be likely to cause a discussion amongst the members. I am, as you are aware, a pretty busy man, but I have so much at heart the interests of the Association that I thought over all possible subjects. I thought that a subject of vital interest to every member of this Association who is really interested in the cotton industry would be the new automatic stop appliances which have been invented during the past few years for use on the power loom. I therefore wrote a paper, not with the purpose of stating my own views, but a paper which I thought would cause the whole questions to be thoroughly and impartially discussed. I am myself, on that question, a seeker after truth. It is quite true that years ago I thought so well of the automatic loom that in the mill

in which I was then and am now manager I put some of those looms, but I was far from being satisfied that those looms were capable of manufacturing *to the best advantage all* kinds of goods, and as I was too busy, living as I do in Canada, to come around here and find out the truth for myself, I thought that by starting this discussion I, and all of you would also be able to learn some truths. Therefore, I wrote that paper. I am not a literary man, I am a manufacturer, and it may be that in writing that paper I used some words not quite correctly as to their true English sense. One of the vice-presidents of this Association, Mr. G. O. DRAPER, took exception to one word I used, namely, "axiom." At the meeting at Washington, he made a personal attack upon me. I was unfortunately unable to attend the meeting. Instead of discussing the question touched upon in my paper, he took this opportunity of making upon me a more or less personal attack. He insinuated that the looms which I had put in years ago into the mills of the Montreal Cotton Company at Valleyfield, Canada, were being used for the manufacture of fine goods. It is not true, gentlemen. Those looms are today weaving *exactly the same description of cloth as they were ordered for*, years ago. Now, my position is rather a peculiar one, because although I am a believer in the Draper loom for certain kinds of goods, Mr. G. O. DRAPER thought it right to attack my paper as if I were an enemy. We had some correspondence together and in the course of that correspondence he justified his action by stating that he had to protect the well being of 2,500 mechanics at Hopedale. Now, gentlemen, I have no objection to Mr. DRAPER looking after his own work people, but so long as he is a vice-president of this Association I hold that it is his place to consider the interests of this Association before the interests of 2,500 mechanics at Hopedale. And I think that instead of trying to quash discussion on that most important matter, it was his place, as a vice-president of this Association, to have helped on the discussion. I sent him a challenge which he has not accepted. He said that he would accept it provided his partners did not object. Well, as I heard

nothing further I could only believe that his partners did object. But as Mr. DRAPER has now left that firm I am hoping that he will see his way to accept my challenge and give the information that I ask. It is for this reason that I have asked permission to say these few words, as I desire that my challenge shall be printed in the proceedings of this Association. I asked Mr. DRAPER to furnish a statement. I will read what I wrote.

"I now challenge you to publish the cost of manufacturing a cloth of a stated quality, say 40 inches wide, 96 ends per inch, 60's twist and 96 picks per inch of filling of 70's pin cop, under each of the following conditions:

"A. In a weaving mill of 1,000 looms of best construction, old style.

"B. In a weaving mill of 1,000 looms, old style, to which stop motions are applied.

"C. In a weaving mill of 1,000 Northrop looms.

"You will state the capital invested in each mill; the number of cuts produced, *working the same hours in each mill.*

"The weaving price paid in each case.

"The proportion of seconds expected.

"The cost of drawing-in or twisting.

"The cost of loom fixing.

"The cost of repairs, general and special, such as shuttle repairs.

"The percentage of waste.

"The cost of interest and depreciation."

Also whether an amount should not be debited against the loom to which automatic appliances are affixed because of the extra quality of yard required as admitted by the advocates of the stop motion.

"It may then be possible to decide whether the extra cost of interest depreciation, repairs, loom fixers' wages, the extra work and perhaps the extra number of seconds, combined with the cost entailed by having to use an extra quality of yarn, may or may not have eaten up most, if not all of the saving effected in the amount paid to the weaver for weaving."

That, gentlemen, was my challenge, and I hope, now that Mr. DRAPER has time upon his hands, that he will accept my challenge and that we shall be placed in possession of facts to enable us to judge whether it is advantageous for us to weave our cloths in the old fashioned loom, or in the old fashioned loom with the stop motion applied, or in the new Draper loom with the stop motion applied, or in the new Draper loom or Stafford loom. We are here seeking for truth, and I hold this, that if a thing is true it will bear the light of full investigation.

The PRESIDENT. This subject, of course, would be of interest if the information could be obtained; but as it stands now it is simply a personal matter, as I understand it, between this gentleman and Mr. DRAPER, and therefore unless there is unanimous consent granted for further discussion I will consider the matter closed for the present. We have other papers that should really come before this meeting at the present time. Does Mr. DRAPER wish to make any personal explanation for the moment?

Mr. GEORGE OTIS DRAPER. Pardon me?

The PRESIDENT. Does Mr. DRAPER wish to make any personal explanation?

Mr. GEORGE OTIS DRAPER. Why, Mr. President, I have some doubt as to whether my personal differences with Mr. SIMPSON are a matter of interest to this organization. I will say for Mr. SIMPSON'S benefit that in response to a letter received by me and also sent at the time to all the leading trade journals, I did write a long reply which was ready for publication, and I will say that my associates, after looking into the matter and reading what I had prepared, decided that the public were probably not so much interested in this discussion as we were ourselves, and they decided not to have the reply circulated. I am not prepared at this minute to answer Mr. SIMPSON'S questions; it would take more or less investigation to reply to

them, but I might say here, now, that it is very easy to challenge a party to produce information that may exist, but which it is very difficult for him to get at. I know very few mills in this country that are willing to give me their costs and the details of their manufacture. I know very few mills that have one thousand looms running on any one definite class of goods that can be compared with another mill with a thousand looms running on similar goods. It would take a long while to get at such information and I should have to have the cooperation of the mills themselves. If Mr. SIMPSON would aid me in getting at the figures I might accommodate him, but I will not attempt to take up a challenge of that nature without first ascertaining whether I can get at the information necessary to reply to it. In challenges of a more mortal nature it is not the place of the party challenging to choose the weapons, and I might stand on my rights and decide that I would myself determine more as to the nature of the evidence which would meet the question between us. I think that is all that is necessary to say now. I am perfectly willing to reply to any questions about which I can furnish immediate information.

Mr. LOUIS SIMPSON. I have no war with Mr. DRAPER in this matter; I am speaking for truth, and I shall be willing to give all the help I can to Mr. DRAPER so that the truth may be put before the members of this Association. I have nothing against MR. DRAPER in this matter; all I want to find out is how I can best and cheapest manufacture a certain line of goods, and it will be of advantage to every member of this Association if reliable data are put before them.

The PRESIDENT. The next paper will be read by the Secretary in the absence of its author, Mr. WILLIAM HOWORTH of Bolton, Eng., who is a representative of several associations engaged in cotton manufacturing representing a capital of over eight million pounds sterling which has interested itself particularly in the cultivation of cotton in West Africa.

COTTON CULTIVATION IN WEST AFRICA.

WILLIAM HOWARTH, 66 Mackenzie Street, Bolton, Eng.

A sense of gratitude for the many kindnesses shown to me during my visit to America left me no option but to comply with your Secretary's request to prepare this paper.

A desire to remove the misconception of the American planter both as to the reasons which led to the formation of the British Cotton Growing Association, the possibilities which lie before it, and the success which so far has attended its efforts, was also in my mind.

In the year 1901, a discussion took place in the Oldham Chamber of Commerce, the subject being "The Growth of Cotton, can it be increased, especially within the British Empire." During the discussion the opinion was expressed, "that unless new sources of cotton supply are found, the Lancashire trade will, within a very few years, find very great difficulty in getting an adequate supply of raw material."

Subsequent investigation proved the opinion to be well founded. America herself contributed to this view. The Washington Census Bulletin, issued June 20, 1902, contained the following on cotton consumption:

"It appears that the crop of South Carolina needed to be supplemented by almost exactly 100,000,000 pounds drawn from other states to supply its spinners, that the North Carolina crop was deficient more than 34,000,000 pounds, that Alabama made use at home of two-thirds of its crop, that the great cotton growing state of Georgia consumed more than one-fifth of its crop, and that even Virginia that had made

less progress in the industry than the states farther south consumed more than one-twelfth of its crop.

"At the present rate of progress it will not be long before the entire cotton supply of the states on the Atlantic seaboard will be taken at home. More than half of it was taken during the census year here reported, for of the 1,260,000,000 pounds raised by the states mentioned, their own mills took 651,800,000 pounds.

"Co-incident with the above it was also noted that takings of Egyptian cotton were also largely on the increase."

I need not weary the members of an association like yours with statistics. I take it that each member knows that America has not stood alone in the enormous strides she has taken in the production of cotton manufactures. The movement has been world-wide. Not only are the people of the world growing wealthier and wiser but new uses for cotton are constantly being found.

The features enumerated presented themselves strongly to the leaders of the Lancashire trade. America held out no hope of being capable of meeting the expansion.

Lack of labor, owing largely to industrial developments, the migration of the negro to the towns and poor transport facilities for handling a large crop were cited by a well known American cotton expert, Mr. HENRY KITTREDGE, as disturbing influences. The Lancashire spinner also felt that by extending the area of cotton production over as wide a surface of the earth as possible we should be less liable to crop flunctuations.

Further, the ideal of the American people seemed to be to manufacture the whole of the cotton they grew. Englishmen could not quarrel with an idea of this character. Neither could they be expected to quietly see the development of an ideal, which in its consummation meant the extinction of England's premier manufacturing industry.

These views were put forward at a meeting held in Manchester on May 7, 1902, and the following resolutions were adopted: —

1. That, in the opinion of this meeting the continued prosperity of

the British cotton industry depends on an increased supply of cotton and it is desirable that our sources of supply should be extended.

2. That a guarantee fund of £50,000 be raised, to be spread over five years, no guarantor being required to contribute more than one-fifth of his total guarantee in any one year.

The £50,000 was subsequently raised to £100,000. I mention these figures because the planters of the South expressed the view that the British Cotton Growing Association had lost millions of capital "in attempting to grow cotton in a country where God never intended that cotton should be grown."

With regard to these finances I may say that the Association has now been placed on a semi-commercial basis with £250,000 paid up, and although the terms of the charter expressly declare that "no dividend shall be paid for a period of seven years, but that all profits shall be devoted to the extension of cotton growing," the Association is being worked on lines which offer promise of enabling a reaping by and by.

The Association was fortunate in having among its promoters Mr. J. ARTHUR HUTTON, Mr. J. E. NEWTON, and many others of the commercial and industrial leaders of Lancashire, and a survey of the cotton growing possibilities was quickly made.

Professor WYNDHAM R. DUNSTAN, F. R. S., Director of the Imperial Institute, South Kensington, laid down the general rule that, —

"Cotton may be successfully grown in those countries which fall in a region lying roughly 40 degrees North and South of the Equator, providing that the soil is appropriate and that the rainfall or irrigation is sufficient.

"Within this region the following British Colonies, Protectorates and Dependencies are included: — British Honduras, The West Indies, British Guiana, Gambia, Sierra Leone, The Gold Coast, Lagos and Nigeria, East Africa and Uganda, South Africa, Mauritus, The Seychelles, India, The Straits Settlements and Federated Malay States, Australia, New Guinea, Fiji, Egypt, Cyprus and Malta.

"In most of these countries the rainfall is adequate, and in those in which it is deficient irrigation is possible in nearly every instance."

It was obviously impossible for the Association to extend its operations over so wide a field. The West Indies, East and West Africa and India were deliberately selected as being the countries which offered to respond most quickly to well directed effort.

Communications were opened up with the West Indies and a large number of white planters expressed themselves as being prepared to experiment in the growing of Sea Island cotton in the West Indies.

The pioneer work was already far advanced, Sir DANIEL MORRIS, the Imperial Director of Agriculture for the West Indies, had for some time been working out in a thoroughly scientific manner the agricultural possibilities of the islands under his control.

As an alternative to sugar and fruit, Sea Island cotton, which by the way, is supposed to have had its origin in Barbadoes, was looked upon with favor. Sir DANIEL relieved the British Cotton Growing Association of all anxiety, with regard to the agricultural side of the movement and beyond setting up a few ginneries and sending financial aid to needy planters the Association was not called upon for material help. In the second season, Mr. E. LOMAS OLIVER of Bollington, who spins the finest Sea Island yarns, visited the West Indies and explained to the planters the qualities which lent value to, or depreciated Sea Island cotton. He also pointed out the types the market could easily absorb.

How well the advice of Mr. OLIVER was taken to heart, and how comprehensive the instruction of Sir DANIEL MORRIS must have been is shown by the 5,057 bales which reached England from the West Indies last year and the high comparative prices realized.

It may also be incidentally remarked that had it not been for the relief afforded by the 5,057 bales referred to there would, last year, have been an insufficiency of this type of cotton.

In India the problem was of a different character. Although a well organized Agricultural Department existed cotton was

not one of its chief studies. And yet, India must, at one time, have been the chief cotton producing country of the world and in the days long past grew the cotton from which the fine muslins of the east were made. An analysis of the statistics showed that while America produced, on an average approximately 200 pounds of lint cotton to the acre, India, through various circumstances only produced 80 pounds of lint from a similar area.

The attention of the India Goverment was called to the economic loss which the country was sustaining, through this small production per acre. Experts were therefore called in and these experts have since been engaged in working out experiments in the United Provinces with a view, not only of securing a higher yield, but also a cotton of better grade. There is every promise that the results aimed for will be achieved. Success in this direction means an impetus to the trade of the world which can scarcely be measured.

But it is to West Africa that the energies and moneys of the Association have, in the main, been directed. During the American Civil War some £76,000 worth of cotton was shipped from the colony of Lagos to Liverpool. After the conclusion of the war the shipments ceased. It is not unfair to assume that the cotton which came in the panic days was due to merchants sweeping the coast towns of all the native cotton they could buy. When the panic subsided and prices became normal, the merchants, dealing in less bulky and more profitable commodities, ceased to interest themselves in cotton and the possibilities of West Africa as a cotton producing country were forgotten. But, with the birth of the British Cotton Growing Association a new era began. Sir ALFRED JONES, the president of the British Cotton Growing Association, and others associated with him in trade brought the claims of West Africa before the Association. It was stated that cotton grew wild in almost every colony, and, that although no cotton was exported, the natives away from the coast towns were clothed in clothes spun and woven from native cottons.

Several American cotton experts were engaged and were instructed to make a survey of the Gambia, the Gold Coast, Sierra Leone, southern Nigeria and northern Nigeria. The reports of these experts confirmed all that the West Coast merchants had stated. Cotton was indigenous in every colony. The soil and the climate was in each case suitable and with the exception of the Gold Coast, where the gold mines drained the labor, ample, cheap and in some respects efficient labor was available. In every case the natural conditions were such as to justify the Association in looking upon these colonies as promising cotton fields. Subsequently it was decided that competitive products in Sierra Leone and the small area of the Gambia were limiting influences which would, in the two sections named, tell against cotton being produced to any large degree.

It was to Lagos and Nigeria that the efforts of the Association were directed. Much experimental work required to be done. Tha native types of cotton were found to be of a Peruvian class with a brownish cast. In a few places cotton of a whiter and smoother quality was found, but generally speaking, the native cotton was not of a character which commended itself to the Lancashire trade.

The council of the British Cotton Growing Association decided that it was of the utmost importance that all undesirable types should be eliminated from West Africa and that a class should be grown suited to our needs. To this end the energies of the Association have been consistently directed. Probably for centuries, succeeding generations of Africans have been planting in a haphazard and promiscuous fashion the cotton seed which came into their hands. Cotton was cotton, and whether good or bad from a white man's standpoint, it was all equally valued by the native.

To instruct the native in relative values and simultaneously give him confidence in the Association, to establish seed farms for the selection of cotton types and the development of hybrids, and to erect ginneries so as to secure full control of the seed were duties which the Association undertook to carry through.

Surely no light task. English, scientifically trained agriculturalists were sent out to Lagos and Nigeria, and they have laid the foundations upon which a great industry will undoubtedly be built.

Briefly put, the Association came to the conclusion that, whether planted in West Africa or in any other part of the world, cotton of any variety other than Sea Island, must necessarily be a black man's crop. The return per acre is not sufficient to adequately remunerate white men. The idea of purchasing estates, although land at a nominal price could be secured, and endeavoring to run them at a profit was definitely set aside. I believe it is a truism of the black man as of other sections of humanity, that he works best when he is his own employer. When this decision was come to, it was fully realized that the Association was putting aside the possibility of making a quick movement but on the other hand, it was also seen, that, if the natives could be got to take an active interest in the work, the field of effort would be of a gradually widening character and whatever success was achieved would rest on a permanent basis. To secure the confidence of the natives, agents of the Association visited the most important centres of population and promised that a market should be found for all cotton tendered and that the price would be two cents per pound for seed cotton. The officers of the government in many cases accompanied the agents of the Association and verified the accuracy of the declaration.

A small ginnery was also established at a place called Aro, to deal with any cotton the natives of that district might have by them and also to demonstrate the fact that the Association was not a mere paper one. As previously stated, the cotton which the natives tendered in these early days, was not exactly the type required. Whilst it was strong and usable, a reddish cast with which it was tinged reduced its value. The first seed farm was therefore established in connection with the ginnery at Aro and for the past four years selected native cottons and hybrids of many descriptions have been experimented with. The lines

followed have been almost identical with the system developed with so much success by the State of Mississippi.

The council of the Association, again in this matter, agreed that rapidity of movement should be sacrificed in order that efforts to improve quality should not be wasted. It was agreed that the colonies should be emptied of all cotton seed of poor types. In order to accomplish this a monopoly of cotton ginning was necessary. This has been arranged and ginneries have been established at several points. Photographs of these establishments which are herewith presented, will illustrate, perhaps more effectually than what I say, the progress the Association has made.

The Marlborough ginnery at Ibaden which was opened last year and is capable of dealing with 12,000 bales per year, embraces in its equipment all the best features of American plants and also a gin compress superior to any other existing arrangement. The Alfred Jones ginnery at Oshogbo opened in February this year, is built on lines similar to the Marlborough but is double its size.

Cotton of whatever type tendered at the ginneries, has been accepted and paid for and selected seed given to the natives to enable them to plant for the succeeding season. The results speak for themselves: —

COTTON EXPORTS FROM WEST AFRICA.

1905	1906	1907
2,760	5,687	9,661

in bales of 400 pounds each.

It may be here stated that by using an automatic feeding and weighing arrangement all the bales are made to an exact 400 pounds standard and are pressed to a density of 32 pounds per cubic foot.

It may not appear to American go-ahead spinners that much has been accomplished. We, on this side, however, are quite satisfied. The progress made has been quite as rapid as the

most sanguine supporters of the British Cotton Growing Association anticipated.

The fact that 10,000 bales of cotton have been grown in one season is reasonable proof that the soil and climate is suitable, and we are now entitled to measure up, in any ordinary way, the future prospects.

First then, with regard to Quality. The experiments carried through have shown that certain native types can be so trained as to produce a most desirable class of cotton. The progress made in this direction is well shown by the comparative prices realized for African cotton in 1905 as compared with 1907. In 1905 the bulk of the cotton brought to Liverpool was sold on the basis of Middling American.

During 1907 the greater portion of the crop has realized from 30 points on to 300 points on Middling American, thus showing that from a quality standpoint a marked improvement has been effected.

Quantity.—So far, the work of the Association has been confined mainly to a narrow strip of land running alongside the railway from Lagos to Ibaden, a distance of 120 miles. Lack of transport facilities prevented a wider movement. Head carriage with 60 pound bundles has been the only method generally available for getting produce from interior points. In addition to this the palm oil and ground nut industries are competitive in the area the Association has so far operated in. The Association has steadfastly refused to open up stations in outlaying districts. Under these conditions the 10,000 bales secured last year must be looked upon as a marvellous result.

Beyond Ibaden, there is a tract of country equal in area to more than one-third of the possible cotton growing field of the United States. There is no competitive industry. The natives numbering fifteen millions, after centuries of inter-tribal warfare, are settling down to the one industry they understand, that of agriculture. Of cotton itself they have some knowledge. I have heard a Government officer who has been up to Kano, the commercial centre of this country and which is, by the way, a black

man's town of over 100,000 inhabitants, declare that thousands of bales of native grown cotton are marketed, spun and woven each year.

The British government has now decided that this country shall be provided with proper transport facilities.

Sir PERCY GIVOUARD, the high commissioner of northern Nigeria, is even now getting up the materials for the construction of a railway from the Niger to Kano. Simultaneously the Lagos railway is being pushed forward with all speed, and two district arteries will shortly be available for the discharge of the products of Nigeria. The British Cotton Growing Association is ready to follow up the work it has begun and to make the most of the vast field opening up to view. I do not think it is an undue optimism which looks for an increase in the production of African cotton in a regularly increasing ratio, until we have an annual production of 5,000,000 bales. What the natural price of this product will be it is difficult to determine. At the moment the usual proportion of lint to seed cotton is approximately 30 per cent. The price which the Cotton Growing Association pays, and which the native looks upon as an adequate return for his labor is, as already stated two cents per pound of seed cotton. Taking buying expenses into account the price of clean lint is approximately eight cents per pound. This assumes that the value of the seed will equal the ginning costs. As the industry widens, it may be possible to vary the price in accord with market values. The Cotton Association is familiarising the natives with currency and he is a bold man, indeed, who is prepared to argue that the African on his native heath will not make as great a success of cotton growing in the future years, as his cousin of the United States of America has done in the past.

The following illustrations show the buildings in the districts referred to in the foregoing paper.

FIGURE 1 — WEST AFRICAN COTTON.
Shipped by the British Cotton Growing Association, May 1, 1907.

FIGURE 2 — AMERICAN COTTON AT LIVERPOOL.
Photographed same day as the preceding illustration.

FIGURE 3—STAFF BUNGALOW,
Lafenwa, Lagos, Southern Nigeria.

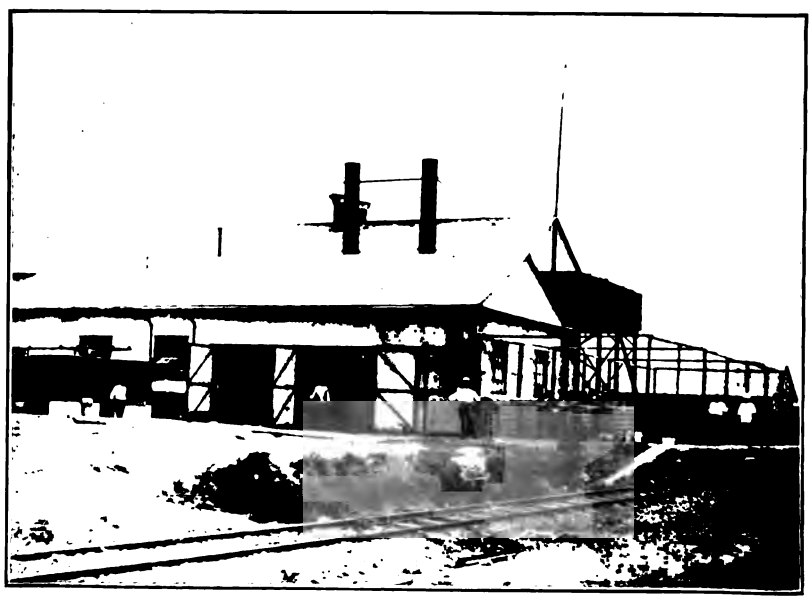


FIGURE 4—CHURCHILL GINNERY,
Lafenwa, Lagos, Southern Nigeria.

FIGURE 5—FRONT OF CHUCHILL GINNERY,
Lafenwa, Lagos, Southern Nigeria.

FIGURE 6—CHURCHILL GINNERY AND ENGINE HOUSE,
Lafenwa, Lagos, Southern Nigeria.

FIGURE 7—MARLBOROUGH GINNERY AND OIL MILL,
Ibadan, Lagos, Southern Nigeria.

FIGURE 8—BUYING SEED COTTON, MARLBOROUGH GINNERY,
Ibadan, Southern Nigeria.

FIGURE 9—SITE FOR "ALFRED JONES" GINNERY,
Oshogbo, Lagos, Southern Nigeria.

FIGURE 10—GINNERY AT IWO, LAGOS, SOUTHERN NIGERIA.

FIGURE 11—NEWTON GINNERY, LAKOJA, NORTHERN NIGERIA.

The PRESIDENT. Has anyone any comments to make upon this paper? If not, we will proceed to the next on the program. The next paper is by a gentleman who has been long connected with the wholesale trade in fabrics and through his ancestors on the French side, as I understand it, was largely interested in the conditioning process which he has undertaken to develop in New York City, first in connection with the silk industry and later in that of cotton. I have the pleasure of introducing Mr. ROBERT J. HOGUET of New York.

CONDITIONING COTTON YARNS.

ROBERT J. HOGUET, 138 Spring Street, New York City.

Permit me in the first place, to express my appreciation of the opportunity afforded me, of placing before you some facts affecting the question of the application to textiles in general, of conditioning and other tests, on the plan long adopted in Europe and which for many years has been carried out here as to silk, both in the raw and thrown (or spun) state.

Such tests are of three kinds, those of the raw material, of the yarn, and of the finished product. While they comprise the determination of count, twist, elasticity, strength and other qualities, their principal object is the accurate establishment of the total quantity of moisture in the raw and semi-manufactured material, or in other words, to ascertain the absolute dry weight. To such weight is then added the normal percentage of moisture established by custom, the result obtained being the "conditioned weight" or correct weight of the article. The absolute dry weight of the contents of a bale is a constant and unchanged quantity, (as long as no portion has been removed) in the same way as the weight of a railroad car as marked, on being deducted from the gross, shows the net weight of the contents. The actual weight of a bale naturally varies according to atmospheric or other influences, but its dry weight remains the same.

TESTING RAW MATERIALS.

In ascertaining the absolute dry weight of raw material in the unmanufactured state, the principal difficulty is to draw such samples as may properly represent the bulk. On this point a

valuable report was presented at the April, 1907 meeting of this Association by the committee on Moisture in Baled Cotton, signed by our president, Mr. W. D. HARTSHORNE, Chairman, Mr. C. P. BROOKS, and Mr. L. A. OLNEY. The chairman had already in September, 1905, read an interesting paper at the Atlantic City convention, on Comparative Data on Moisture in Cotton and Worsted, recording the results of experiments made under his direction, while the general question of moisture in textiles was ably treated at the convention of September, 1906, by our ex-president, Mr. J. R. MACCOLL, who expressed himself as follows:—

"Excessive damp in cotton, with inadequate allowance when discovered, is a grievance which European spinners complain bitterly of. It is possible that in this country we have not given sufficient attention to this and that a large unseen loss is occurring in many mills. . . . Our Association could do good service by instituting a series of tests to determine the practicability of establishing this as an exact standard for buying cotton. . . Those of us who are woolen manufacturers know how essential it is to watch closely the moisture in raw material and finished product."

The report of the committee on Moisture in Baled Cotton, to which I have already referred, and with which you are familiar, recorded the fact that experiments made on 22 bales resulted in an excess of moisture beyond the normal 8½ per cent. having been found, in quantities varying from half a pound to 40 pounds 8 ounces per bale. The processes for establishing the absolute dry weight and the conditioned weight were exactly those which our Works employ. Whenever the industry calls on us for such tests they can be promptly and accurately furnished.

Whether or not such a fact might justify a claim on the seller, every mill owner should know how much water in excess of the normal percentage, he is buying at the price of silk, cotton, wool, or other textile. Custom has established 11 per cent. for silk, 8½ per cent. for cotton, 12 per cent. for flax and hemp, 12½ per cent. for tow yarn, 13¾ per cent. for jute, and for woo

at various stages from 16 to 19 per cent. Any excess of moisture beyond these rates implies loss for the buyer and gain for some one else.

Manchester spinners have been urging the adoption for raw cotton of moisture tests on the same principle as those of wood pulp, conducted at the Manchester Testing House. From recent experiments we have found our methods as to the latter class of tests uniform with those of Manchester, and hence undoubtedly applicable to raw cotton. At what point conditioning should take place, whether at time of packing, at time of sale, or at its final destination, and whether generally or only in cases of complaint are points for consideration and discussion.

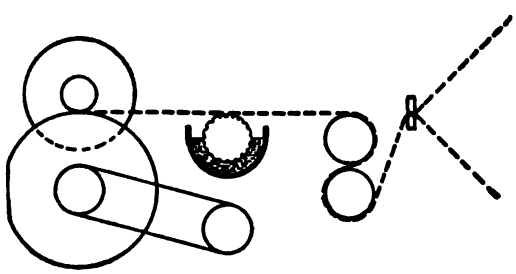
MOISTURE IN YARN.

Established standards for moisture in textile materials are as important for both buyer and seller as are established standards for money or for weights and measures. A variation in the quantity of water in a lot of raw material or yarn has the same effect on the buyer's and seller's bank accounts as an alteration in the size of the pound or in the number of cents in a dollar would have. The buyer and seller are protected against loss by a variation in the standards of value, weight or measure. Conditioning, or the testing of textile materials, is needed to complete this protection to those who trade in those staples. The amount of moisture in textile materials is constantly varying by natural evaporation and absorption from the air and by the application of water at the different stages in the process of manufacture. The natural variation extends over wide limits, as is shown by the following extract from a report of tests of worsted yarn by President HARTSHORNE of this Association:

"The great variations in the weight of this skein of yarn were remarkable. The moisture it contained ranged from a little over 7 per cent. to as high as 35 per cent., often with a variation of from 15 to 20 per cent. in twenty-four hours."

This capacity to absorb and throw off water makes it possible

to effect great changes in the weight of textile materials by simply storing them in damp or dry places. The direct application of water to these materials is a means of effecting even greater changes in the weight. Illustrations of these practices will occur at once to all of you. Mr. H. W. MACALISTER, of Manchester, Eng., tells of his seeing cotton presses in the South equipped with steam pipes "for the express purpose of injecting steam into the bales." On the other hand it is the common practice of Lancashire spinners to "damp" their yarn before weighing and invoicing it for shipment. The result is that water is sold in the former case at 10 cents a pound; in the latter case at 20 to 40 cents a pound, or even more. Nor is this practice of damping yarn confined to Lancashire. It is practiced on the Continent and in America. The accompanying drawing shows



SECTION OF YARN SATURATING DEVICE.

a section of a device for saturating yarn with water in the spooling process, and which is in use in some of the leading mills making yarn for sale in the United States. A corrugated brass roller running in a trough containing water is situated half way between the rollers and yarn guide. The yarn passes over this wet roller and absorbs a large quantity of water just before it is wound solidly on the spool.

The artificial, like the natural moistening of textile material is confined to no particular country or branch of the industry. It is firmly established as a natural and artificial factor in the textile trade and this is what makes it necessary for every person who buys or sells textile materials to protect himself against loss by adopting a reliable method of testing or conditioning all the material bought or sold.

PERCENTAGE OF MATERIALS IN COST OF PRODUCT.

Having, I trust, established the relevance and importance of the subject of textile tests, I propose to glance at its business aspects and to illustrate its vital importance as a factor in the manufacturer's calculations and still more so in his balance sheet. Much attention has been given, both by the manufacturers and their advisers, to economies resulting from improved factory systems, saving in fuel, utilization of waste and other up-to-date methods. Yet the average aggregate expenditure of a textile manufacturer outside of the cost of material, only represents about one third of the cost of production. This is not a mere estimate, but it is the actual result shown by the census returns of 1905, according to which our aggregate textile product for that year represented $1,215,000,000 and the aggregate cost of production $1,114,000,000. The latter figure was composed as follows: —

	Millions of Dollars.	Percentage.
Materials	746	67
Wages	249	22
Administration	33	3
Miscellaneous	87	8
Total,	1,114	100

While the average cost of textile materials thus represented 67 per cent. of the cost of the product, the proportions of the separate items were: —

	Value of Product 1905. Millions of dollars.	Cost of Product 1905. Millions of dollars.	Proportion of cost of Material to cost of Product. Percentage.
Cotton goods	450	422	68
Knit goods	137	123	62
Manufactures of Wool	381	345	70
Manufactures of Flax, Hemp, and Jute	63	59	77
Silk Manufactures	133	121	63
Dyeing and Finishing	51	44	44
Total Value	1,215		
Total cost		1,114	

Grouping the purchases of raw materials more or less intimately connected with the work of our membership, we are spending on cotton, wool, flax, and jute approaching a billion dollars a year without any organized system of testing; the silk industry (where the average proportion of material to total cost is only 63 per cent. as compared with 68 per cent. for cotton goods) being practically the only branch of textile manufacturing in which conditioning has been generally adopted, although augmented interest, in the shape of tests, is being constantly manifested in the subject by other branches of manufacture, as our daily records demonstrate. This is largely due to the attention given to the subject in the textile press both at home and abroad. One Austrian textile paper lately published a full translation of an article in the Textile World Record on the subject of conditioning, written by Mr. S. S. DALE, who has for years advocated the general adoption of conditioning by American manufacturers.

COST OF MATERIALS TO SMALLER MANUFACTURERS.

While the 68 per cent. proportion of cost of materials to that of their product, shows the importance of conditioning to manufacturers of cotton goods, this percentage when investigated represents for the $422,000,000 of cost, (corresponding with

$450,000,000 value of product), a total outlay for materials of $286,000,000, including $222,000,000 of the principal articles purchased in the raw state and $34,000,000 in the semi-manufactured state, or in the form of yarns. Owing to the higher cost of the latter in proportion to the total manufacturing cost, it would seem that manufacturers who buy their yarns are probably paying out for that purpose at least 75 per cent. of their outlay for material. While the above figures apply to the general production of cotton goods (other than knit goods), in the case of cotton smallwares conditions are reversed. Out of a total cost of materials in the latter industry amounting to three and one-half million dollars, over ninety per cent. represents those purchased in a semi-manufactured state. Of the latter proportion over ninety-three per cent. was cotton yarn. These returns emphasize the importance of conditioning to the smallwares industry, in which Rhode Island leads as to value of product.

COMPARISON OF NEW YORK AND MANCHESTER CONDITION TICKETS.

New York Ticket.

	Lbs.	Kilos.
Net weight of bundle,	10.00	4.540
Absolute dry weight,	8.77	3.980
Add regain at 8½ per cent.,	.73	.330
Correct invoice weight,	9.50	4.310
Excess moisture,	.50	.230
Weight of sample before desiccation,	grams	683.9
" " " after "	"	600.6

Here is a clear saving of 5 per cent. for the manufacturer as the result of conditioning. What better proof can be given of its value?

The system adopted at the Manchester Testing House is practically the same as ours, as may be seen from the following specimen of the certificate issued by the former establishment:—

Manchester Ticket.

Net weight of bundle,	9 lbs. 13 oz. 8 drams.
Total moisture,	10.25 per cent.
Absolute dry weight,	89.75 "
Regain at 8½ per cent.	7.63 "
Correct invoice weight,	97.38 "
Excess moisture,	2.62 "
Correct invoice weight of bundle,	9 lbs. 9 oz. 6 drams.

MANCHESTER TESTING HOUSE ADJUSTING DISPUTES.

While the question of testing raw materials presents the difficulty of drawing samples in such a way as to accurately represent the bulk, the same cannot be said of yarns, where a bundle or even a smaller quantity can be tested, after being forwarded to the conditioning house in an air-tight receptacle with note of weight at time of despatch. The relatively higher value of yarns, moreover, permits of expense being incurred for tests, particularly of the finer counts. As an instance of the practical value of yarn tests, it is worthy of note that the yarn contract rules adopted in 1896 at the Manchester Yarn Contract Conference, included the following clause: —

"Rule 5. In case of dispute as to counts, length, weight, or condition, the yarn shall be tested by and according to the rules of the Manchester Testing House, and its certificates shall be binding on both parties, who, however, shall have the right to be represented when the samples are drawn."

In Austria the co-operation of one of the official conditioning houses with the Court of Arbitration in the settlement of disputes as to yarn, is provided for under the rules of the Vienna Cotton Exchange. The French spinners in their demand for the establishment of conditioning houses in connection with the principal cotton exchanges, urged the merits of the system as applied to yarns at various European textile centers, thus indirectly proving its advantages.

WHAT EUROPE IS DOING AS TO CONDITIONING.

While there are on the Continent of Europe about twenty condition houses mostly handling silks, there are others where wool and other staples form the bulk of the quantity treated.

According to recent statistics, the principal wool conditioning houses in France were handling an aggregate of about ten million pounds a month, of wool in its various forms.

INCREASED AMERICAN IMPORTS AND PRODUCTION OF FINE YARNS.

Statistical returns show that our imports of cotton yarns for the last three calendar years were: —

1905,	5 million	pounds,	foreign	value	2¼	millions	of	dollars.
1906,	6 "	"	"	"	3	"	"	"
1907,	8¼ "	"	"	"	4½	"	"	"

All of this yarn should be conditioned.

We are paying abroad about 55 cents a pound for yarn, which we are importing to double the value of two years ago, when we were paying 40 cents a pound.

While our total production of yarns for 1905 was less than 5 per cent. in quantity above that for 1900, the increase in yarns above No. 40 was 60 per cent. This gain, it is of interest to note, included the development of fine spinning in the South, from less than a million pounds above No. 40 in 1900 to eighteen million in 1905. Fine yarns, on account of their price, naturally call for the process of conditioning more than lower counts. Everything, therefore, points to an increased use of the system by manufacturers.

NEW YORK AS A CONDITIONING CENTRE.

Much more could be said to emphasize the vital importance of the movement I am here to support, for the establishment of conditioned weight as the standard of our transactions in yarns, whether or not it is found adaptable to our purchases of raw

LABORATORY OF THE NEW YORK SILK CONDITIONING WORKS.

cotton or other textile materials. It is particularly a question for this part of the country. Out of the $34,000,000 worth of cotton yarn annually purchased by our manufacturers, $29,000,000 worth is consumed in New England and the middle East, comprising New York, New Jersey, and Pennsylvania. The largest buyers of yarn are, therefore, within such a short distance of New York City as to render that point an ideal location for a Testing House, giving American manufacturers all the advantages enjoyed by their European competitors. The same arguments I have adduced regarding cotton piece goods, are likewise applicable to knit goods and woolen manufactures, as to which we are equally at the disposal of those interested in our work. I may add that we undertake tests of count, twist, elasticity and strength of all textile materials and fabrics.

NO HOSTILITY TO SPINNERS.

The cordial relations our Conditioning Works have maintained during twenty-seven years with both spinners and buyers of silk yarns, form the best proof of the impartiality of our tests. Without being officious, I may perhaps suggest that the establishment of such a standard as I am advocating might facilitate purchases of yarn under certain circumstances by those larger concerns who, to be quite certain as to the correctness of their calculations, or for other reasons, now spin for the whole of their own requirements.

Spinners need not, therefore, fear any open or veiled hostility in this movement. This is the age of investigation and exact analysis with but one object in view, the discovery of the truth. The sale of yarn on the basis of 8½ per cent. regain, is after all only a matter of calculation. The manufacturer is as little desirous of getting a certain quantity of yarn for nothing, as he is of paying the price of cotton for moisture in excess of the normal percentage.

One of the warmest advocates of conditioning, Mr. H. W. MACALISTER, of Manchester, is himself a prominent spinner. Here are his words at the recent Vienna Congress: —

"We settle in this way disputes of many kinds between spinners and their customers. . . . I had a case not long ago in which a man said my yarn was not right. It was taken to the testing house and the testing house said it was right. I have had no complaint from him since. We ought to do the same thing with our raw cotton. They do it in the silk trade and in the wool trade they deal with the matter of moisture in a testing house."

TESTS OF FINISHED FABRICS.

Our department handling that branch has, as well as our other departments, the most approved modern machinery, as well as the co-operation of an experienced chemist. There is thus no point where we cannot render the American manufacturer as good service as his European competitors are getting. Moreover, through our knowledge of European happenings of interest to manufacturers, we can often render special assistance of a valuable nature.

Gentlemen, it only remains for me to invite you, one and all to come and see us at work in our laboratory and to submit your problems and tests for us to solve, as we have been doing for a quarter of a century for our friends in the silk industry. If we can promote the interests of the great cotton industry and of its affiliated branches, we shall feel amply rewarded for any trouble we may take to elevate the position and further the development of this greatest of our national textile manufactures.

Mr. ROBERT J. HOGUET. (After reading paper.) Gentlemen, it only remains for me to invite anybody who happens to be in the little city of New York to go to our little works and we will give them a practical example of how it can be done; or if they will send us samples we are perfectly willing to do it free of cost. I thank you very much for your attention. (Applause.)

The PRESIDENT. Has anyone something to say on this

subject? It is a matter of very great interest, of course, to manufacturers, to find some uniform method of determining conditions.

The PRESIDENT. If there is no further comment we will pass to the next paper, which will be read by the Secretary. Its author, Mr. WILLIAM MYERS, is one of the leading textile educators of the world and is connected with the Municipal School of Technology at Manchester, England.

TESTING OF YARNS.

WILLIAM MYERS, Lecturer on Textiles, Municipal School of Technology, Manchester, Eng.

In dealing with a subject of this kind it is well at the outset to consider the nature of the tests to which yarn should be subjected, and the best and most efficient methods of applying those tests.

Nature of Tests.—Yarn must be tested for count or number, strength, elongation to breaking point, elasticity if possible, twist, regularity, cleanliness, moisture, and diameter. It is proposed to deal with several of these in this paper, and the remainder will be dealt with in a subsequent paper. The reason for adopting this course is that the whole subject cannot be adequately dealt with in one paper.

Condition of Material to be Tested.—A good deal depends upon the condition of the yarn as to the kind of apparatus which may be used. Yarn may be tested from the cop, the ring bobbin, the hank, the ball warp, the beam warp, and from the woven texture.

Testing for Count.—Assuming that the bulk of the yarn which has to be tested for count will be in the condition in which it has left the spinning machine, it may be well to discuss and determine: first, the most suitable length of material to test to arrive at an accurate result; second, what are the differences to be found in the count of a yarn when various lengths are tested; third, the effects of testing the material from various parts of a cop or bobbin and to note what differences, if any, exist; fourth, the most suitable method of measuring the yarn, the tension to be put

on during reeling and the effect on the length of yarn reeled due to tension and possibly the speed of reeling.

The most common way of testing yarn for count is to wrap a lea from each of several cops or bobbins taken at random

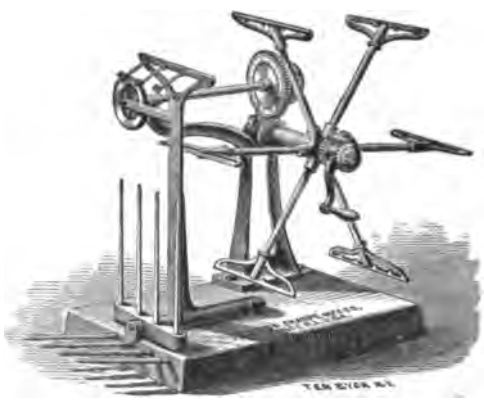
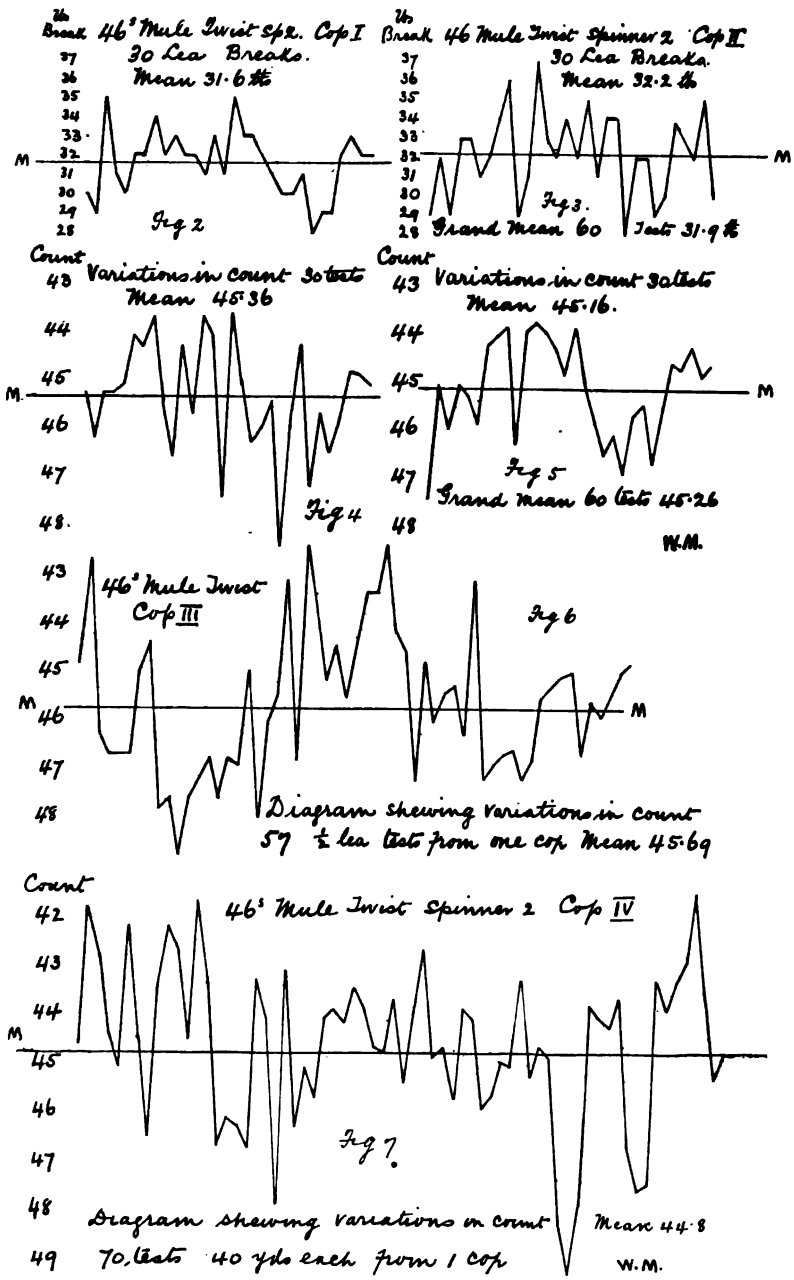


FIGURE 1.—WRAP REEL.

from a delivery of yarn, using a machine of the type shown in Figure 1. Now whilst there may be no particular objection to this plan, it will be found advantageous to vary this procedure and take a number of tests from the middle and near the finish of a cop or bobbin.

The graphic diagrams, Figures 2, 3, 4, 5, show the variation in count from two cops of reputed 46 mule twist. The tests in each diagram include the whole of the cop (30 tests), and it will be seen that whilst the average count is not much below the reputed, the variation is considerable, extending in cop 1 from 43.6 to 48.4 (mean 45.36), and in cop 2 from 43.86 to 47.39 (mean 45.16).

Figure 6 shows the variation in count from cop 3 of 46s mule twist and whilst with 57 half-lea tests the average count is still nearer the reputed count, the variation is much greater, extending from 42.35 to 48.8 (mean 45.69), and in Figure 7, cop 4, 70 tests of 40 yard lengths shows a mean count of 44.8 with a



FIGURES 2, 3, 4, 5, 6, 7.—VARIATIONS IN COUNT.

variation extending from 41.5 to 49.3. The variations in count from other yarns are shown in the figures illustrating the variations of strength in another part of the paper. All the yarns used to illustrate this paper have been spun commercially.

Now having these variations and averages in mind, does it not seem reasonable to suggest that occasionally at least the whole instead of a part of several cops might be tested for count; and whilst there is variation, if it is found that the net result is a good average count, then the manufacturer has had delivered to him all he is entitled to, so far as count is concerned, because in a fabric or in a wrap the average count must be taken into account, as it is this which determines the weight of the texture. This of course assumes that the variations from the reputed count are not excessive. As regards average strength, that is a matter for further consideration.

In connection with the diagrams given, it should be mentioned that the yarns have all been reeled at the same tension, and as far as possible at the same speed. The wrappings have all been weighed on a chemical balance, and readings to $\frac{1}{100}$ of a grain recorded. In all cases the wrappings have been taken consecutively, and thus the variations may be readily traced.

Measuring the Yarn.—Regarding the most suitable method of measuring yarn, it may be said that an expert reeler can adjust the tension by hand, and with constant practice he can reel the yarn at a regular speed, but it is desirable that there should be some more reliable method of obtaining regular results as to length and tension. To remove some of the possibilities of variation, a few spinners and manufacturers have their wrap reels driven mechanically at a fixed rate, and the tension may be regulated by passing the yarn amongst a series of glass tension rods.

At the testing house of the Manchester (England) Chamber of Commerce, there is a specially constructed wrap reel with a measuring, tensioning, and stopping device. Figure 8 shows a front view of the reel with the device attached. The mechanism is constructed to put a definite amount of tension upon the

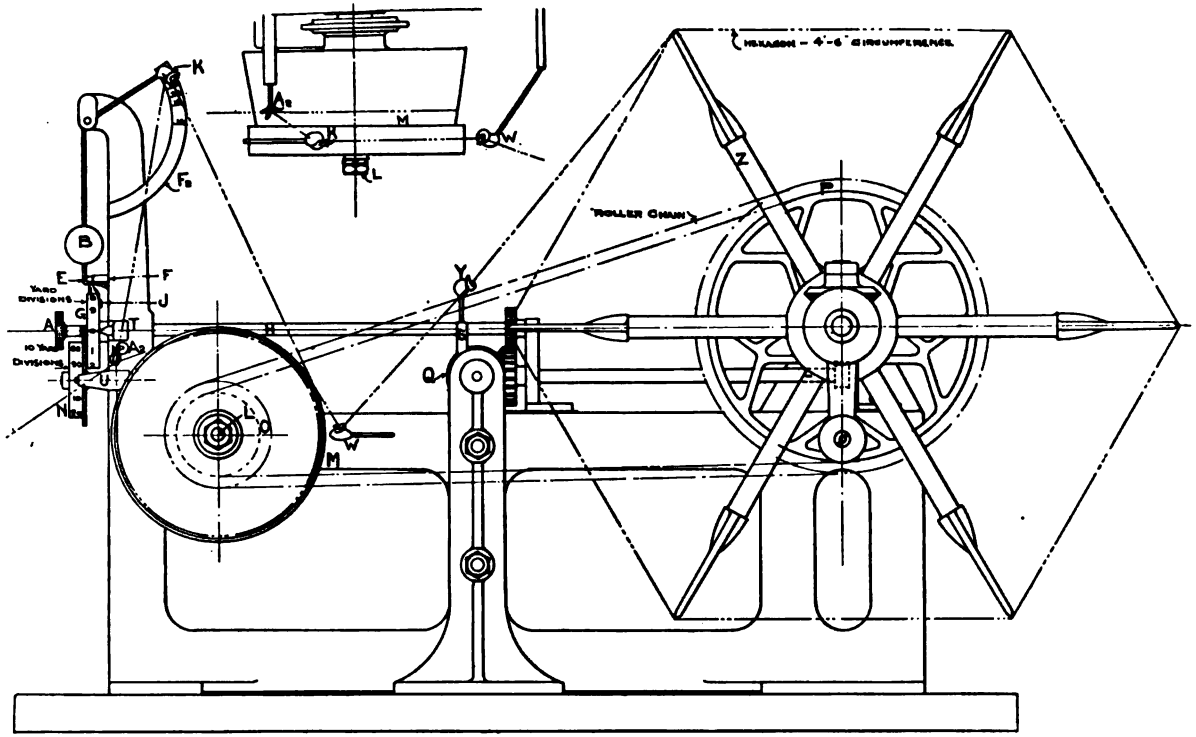


FIGURE 8.—WRAP REEL, MANCHESTER CHAMBER OF COMMERCE.

yarn during reeling, the standard of tension being the weight of 1,000 yards of yarn of the various counts; the speed of reeling does not effect the degree of tension. The yarn to be reeled is passed through a guide eye *A2*, and round a conical drum *M* covered with emery (see detail in upper portion of Figure 8), then again through the eye *A2*, and upwards to an eye mounted on a lever *K* which registers the amount of tension, then the thread is led downward and passed round the measuring drum, through two eyes *W* and *Y* and on to the reel. The degree of tension is governed by the position occupied by the yarn during its passage round the emery covered cone, and the amount of tension is recorded by the pointer at *K* shown on quadrant *F2*. This is a very ingenious and well-constructed machine, and suited to the requirements of accurate measuring; it is, however, rather costly, which will probably prevent its general adoption.

The plan adopted in the tests given in this paper was to pass the yarn amongst a number of glass rods, the number being determined by a series of measurements of the leas wrapped; the reel was rotated at as regular a speed as could be got by hand turning. As regards the determination of the exact length of material reeled, it was thought that if such a tension were put on the yarn that the lea when reeled would just enclose a template ¾ yard long that a correct length would be ensured, and this is practically the plan adopted.

The device illustrated at Figure 9 is designed to measure and determine the length of yarn reeled by hanging the lea on a bar and suspending a weight on the lea by means of a hook which will show on a graduated scale any variation from ¾ yard. The weight must be sufficient to straighten, but not to stretch the threads.

Weighing the Material.—After the yarn has been measured it must be weighed and the count calculated. For accurate weighing nothing is better than a chemical balance and weights graded to $\frac{1}{100}$ grain. This plan, however, does not lend itself to the every day practice of a mill warehouse or office, hence a

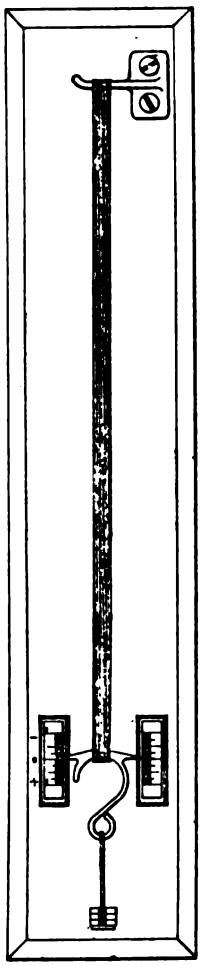


FIGURE 9.
YARN MEASURING DEVICE.

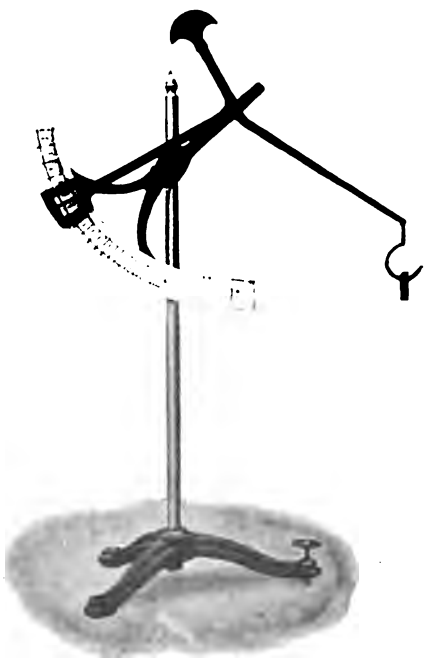


FIGURE 10.
LEA QUADRANT.

number of special balances have been designed to expedite this work.

Lea Quadrant.—Figure 10 shows a machine which is intended to weigh and indicate on the quadrant the count from one to seven leas of cotton. If the machine is arranged for a small number of

leas, say three, then it is desirable when fine counts are being tested to take a double quantity of yarn, as the markings near the bottom of the scale are very close. This machine has its beam mounted on knife edges, the indicating line is very fine and is quite close to the face of the quadrant.

Knowles Balance.—Figure 11 is an illustration of the Knowles Yarn Assorting Balance. This is a more useful machine than the last, and can of course be used for other purposes than that for which it is primarily designed. Its most important feature is that it is a good balance. Behind the beam of the balance is placed an octagonal prism, on seven faces of which are engraved

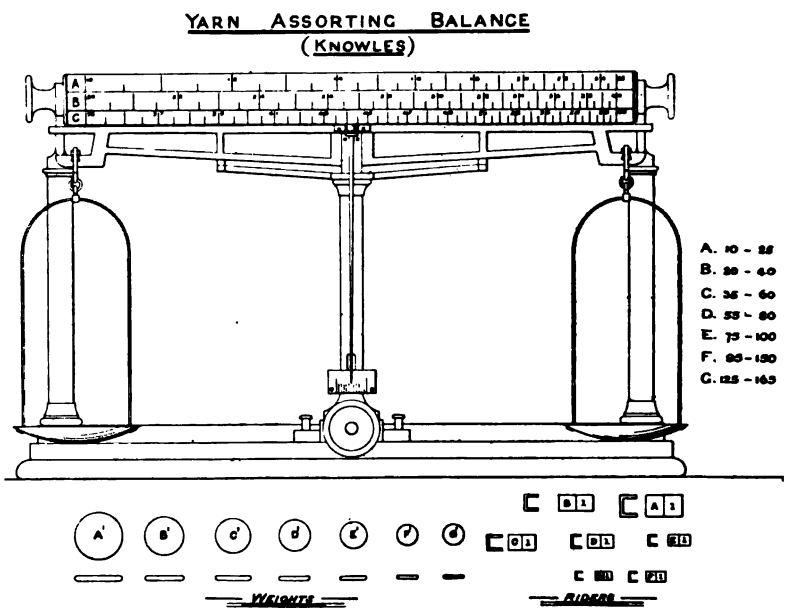


FIGURE 11.

count numbers varying from 10 to 165. Two kinds of weights are used, namely, a flat circular pan weight, and a rider weight, there are two weights for each face of the prism, and each is engraved with a letter corresponding to a letter on the face of the prism, and with a number representing the number of leas

being tested. The balance shown is arranged for testing one lea of yarn, but the weights are also arranged for other numbers of leas. The method of procedure is as follows: the reputed count being known the prism is turned until the face containing the count appears in front, one lea of yarn is placed in the *right hand* pan of the balance, and the properly lettered pan weight in the *left hand* pan, the rider weight bearing the same letter is now placed on the beam, and is moved along until it is opposite the reputed number of the yarn being weighed, a trial is made by raising the beam; if it fails to balance, the beam is lowered and the rider slid along to the right or left until the beam is eventually brought into equilibrium. The count may now be read off on the prism opposite an engraved line in the centre of the rider weight. This plan dispenses with all calculation and reference to tables. It is, of course, a machine which requires careful handling.

Brown & Sharpe's Balance. Figure 12 shows a view of a handy balance of another type and which is designed for weighing leas of yarn. It is made by Brown & Sharpe, the well known tool makers of Providence, R. I. The beam is graded to 20 grains with sub-divisions in $\frac{1}{10}$ grain. For general warehouse work it is a very satisfactory balance.

FIGURE 12.—BROWN & SHARPE YARN BALANCE.

Determination of Count.—When using balances that give only the weight and not the count, it is necessary to obtain the count either by calculation or by reference to tables specially prepared for the purpose.

This introduces the question as to the most suitable kind of weights to be used with an ordinary scale or balance. Some people still use the 1 oz., ½ oz., ¼ oz. and dwt. and grain weights and this practice has been fostered by the use of one of the oldest and best known tables which gives the heavier weights in ozs. and dwts. Figure 13 shows a portion of this table.

	1 LEA.			2 LEAS.			3 LEAS.		
Hanks.	Oz.	Dwt.	Grs.	Oz.	Dwt.	Grs.	Oz.	Dwt.	Grs.
1	2	5	5.000	4½	1	7.250	6½	6	12.250
2	1	2	14.500	2	5	5.000	3	7	19.500
3	½	4	18.583	1½	0	10.416	2	5	5.000
4	½	1	7.250	1	2	14.500	1½	3	21.750
5	0	8	8.000	½	7	13.250	1	6	18.500
6	0	6	22.666	½	4	18.583	1	2	14.500
7	0	5	22.857	½	2	18.964	½	8	17.821
8	0	5	5.000	½	1	7.250	½	6	12.250
9	0	4	15.111	½	0	3.472	½	4	18.583
10	0	4	4.000	0	8	8.000	½	3	9.250
11	0	3	18.909	0	7	13.818	½	2	5.977
12	0	3	11.333	0	6	22.666	½	1	7.250
13	0	3	4.923	0	6	9.846	½	0	12.519
14	0	2	23.428	0	5	22.857	0	8	22.285
15	0	2	18.666	0	5	13.333	0	8	8.000
16	0	2	14.500	0	5	5.000	0	7	19.500
17	0	2	10.823	0	4	21.647	0	7	8.470
18	0	2	7.555	0	4	15.111	0	6	22.666
19	0	2	4.631	0	4	9.263	0	6	13.894
20	0	2	2.000	0	4	4.000	0	6	6.000
21	0	1	23.619	0	3	23.238	0	5	22.857
22	0	1	21.454	0	3	18.909	0	5	16.363
23	0	1	19.478	0	3	14.956	0	5	10.434
24	0	1	17.666	0	3	11.333	0	5	5.004
25	0	1	16.000	0	3	8.000	0	5	0.001
26	0	1	14.461	0	3	4.923	0	4	19.383
27	0	1	13.037	0	3	2.074	0	4	15.110
28	0	1	11.714	0	2	23.428	0	4	11.140

FIGURE 13.—WEIGHT OF HANKS.

This is a very cumbersome method, and one to be deprecated and discouraged. Where an ordinary balance is used, it is much better to use grain weights throughout and these can be purchased along with 0.1 and 0.01 grains. In such cases other tables are used, and the two best are those published by the Draper Co., Hopedale, Mass., which is shown on Fig. 14, and by Mr. ARTHUR WAEFFLER of Basle, Switzerland, a portion of which is shown on Figure 15. WAEFFLER'S table has been designed for one lea tests of single and two and three-fold yarn, which really means that it may be used for one, two and three leas. The Draper Co. table is for one lea only. It will be seen upon careful examination of these tables that a number of cross readings may be made for single leas, such readings being based upon the fact that count and weight are interchangeable terms; thus if we divide by count, weight is the result, and if we divide by weight, count is the result; for example, reading on the bottom line of WAEFFLER'S table, if one lea weighs 84.03 grains then the count will be 11.9 or if it weighs 45.66 it will be 21.9 count. It is generally agreed that only grain weights should be used for weighing wrappings of cotton yarn as the introduction of pennyweights and ounces only leads to unnecessary and undesirable complications.

Variation from Reputed Count.—There does not appear to be any recognized basis of allowance for variation above or below the reputed count of yarn as between the spinner and the manufacturer, the spinner being naturally anxious not to deliver yarn which is appreciably finer and the manufacturer being unwilling to pass yarn which is appreciably coarser than the reputed count. Now to the manufacturer this question of the variation in count is a very important one indeed, particularly if the variation is consistently on the coarse side, and it must be clearly understood that the variation spoken of now is not the variation in one cop, but the average variation from the reputed count.

Table for numbering Cotton Yarn by the weight in grains of 120 yards or 1 skein.

120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.
1.	1000.	14.	71.43	21.	47.62	28.	35.71	35.	28.57
2.	500.	.1	70.92	.1	47.39	.1	35.59	.1	28.49
3.	333.3	.2	70.42	.2	47.17	.2	35.46	.2	28.41
4.	250.0	.3	69.93	.3	46.95	.3	35.34	.3	28.33
5.	200.0	.4	69.44	.4	46.73	.4	35.21	.4	28.25
5.5	181.8	.5	68.97	.5	46.51	.5	35.09	.5	28.17
6.	166.7	.6	68.49	.6	46.30	.6	34.97	.6	28.09
6.5	153.8	.7	68.03	.7	46.08	.7	34.84	.7	28.01
7.	142.9	.8	67.57	.8	45.87	.8	34.72	.8	27.93
7.5	133.3	.9	67.11	.9	45.66	.9	34.60	.9	27.86
8.	125.0	15.	66.67	22.	45.45	29.	34.48	36.	27.78
.1	123.5	.1	66.23	.1	45.25	.1	34.36	.1	27.70
.2	122.0	.2	65.79	.2	45.05	.2	34.25	.2	27.62
.3	120.5	.3	65.36	.3	44.84	.3	34.13	.3	27.55
.4	119.0	.4	64.94	.4	44.64	.4	34.01	.4	27.47
.5	117.6	.5	64.52	.5	44.44	.5	33.90	.5	27.40
.6	116.3	.6	64.10	.6	44.25	.6	33.78	.6	27.32
.7	114.9	.7	63.69	.7	44.05	.7	33.67	.7	27.25
.8	113.6	.8	63.29	.8	43.86	.8	33.56	.8	27.17
.9	112.4	.9	62.89	.9	43.67	.9	33.44	.9	27.10
9.	111.1	16.	62.50	23.	43.48	30.	33.33	37.	27.03
.1	109.9	.1	62.11	.1	43.29	.1	33.22	.1	26.95
.2	108.7	.2	61.73	.2	43.10	.2	33.11	.2	26.88
.3	107.5	.3	61.35	.3	42.92	.3	33.00	.3	26.81
.4	106.4	.4	60.98	.4	42.74	.4	32.89	.4	26.74
.5	105.3	.5	60.61	.5	42.55	.5	32.79	.5	26.67
.6	104.2	.6	60.24	.6	42.37	.6	32.68	.6	26.60
.7	103.1	.7	59.88	.7	42.19	.7	32.57	.7	26.53
.8	102.0	.8	59.52	.8	42.02	.8	32.47	.8	26.46
.9	101.0	.9	59.17	.9	41.84	.9	32.36	.9	26.39
10.	100.0	17.	58.82	24.	41.67	31.	32.26	38.	26.32
.1	99.01	.1	58.48	.1	41.49	.1	32.16	.1	26.25
.2	98.04	.2	58.14	.2	41.32	.2	32.05	.2	26.18
.3	97.09	.3	57.80	.3	41.15	.3	31.95	.3	26.11
.4	96.15	.4	57.47	.4	40.98	.4	31.85	.4	26.04
.5	95.24	.5	57.14	.5	40.82	.5	31.75	.5	25.97
.6	94.34	.6	56.82	.6	40.65	.6	31.65	.6	25.91
.7	93.46	.7	56.50	.7	40.49	.7	31.55	.7	25.84
.8	92.59	.8	56.18	.8	40.32	.8	31.45	.8	25.77
.9	91.74	.9	55.87	.9	40.16	.9	31.35	.9	25.71
11.	90.91	18.	55.56	25.	40.00	32.	31.25	39.	25.64
.1	90.09	.1	55.25	.1	39.84	.1	31.15	.1	25.58
.2	89.29	.2	54.95	.2	39.68	.2	31.06	.2	25.51
.3	88.50	.3	54.64	.3	39.53	.3	30.96	.3	25.45
.4	87.72	.4	54.35	.4	39.37	.4	30.86	.4	25.38
.5	86.96	.5	54.05	.5	39.22	.5	30.77	.5	25.32
.6	86.21	.6	53.76	.6	39.06	.6	30.67	.6	25.25
.7	85.47	.7	53.48	.7	38.91	.7	30.58	.7	25.19
.8	84.75	.8	53.19	.8	38.76	.8	30.49	.8	25.13
.9	84.03	.9	52.91	.9	38.61	.9	30.40	.9	25.06
12.	83.33	19.	52.63	26.	38.46	33.	30.30	40.	25.00
.1	82.64	.1	52.36	.1	38.31	.1	30.21	.1	24.94
.2	81.97	.2	52.08	.2	38.17	.2	30.12	.2	24.88
.3	81.30	.3	51.81	.3	38.02	.3	30.03	.3	24.81
.4	80.65	.4	51.55	.4	37.88	.4	29.94	.4	24.75
.5	80.00	.5	51.28	.5	37.74	.5	29.85	.5	24.69
.6	79.37	.6	51.02	.6	37.59	.6	29.76	.6	24.63
.7	78.74	.7	50.76	.7	37.45	.7	29.67	.7	24.57
.8	78.12	.8	50.51	.8	37.31	.8	29.59	.8	24.51
.9	77.52	.9	50.25	.9	37.17	.9	29.50	.9	24.45
13.	76.92	20.	50.00	27.	37.04	34.	29.41	41.	24.39
.1	76.34	.1	49.75	.1	36.90	.1	29.33	.1	24.33
.2	75.76	.2	49.50	.2	36.77	.2	29.24	.2	24.27
.3	75.19	.3	49.26	.3	36.63	.3	29.15	.3	24.21
.4	74.63	.4	49.02	.4	36.50	.4	29.07	.4	24.15
.5	74.07	.5	48.78	.5	36.36	.5	28.99	.5	24.10
.6	73.53	.6	48.54	.6	36.23	.6	28.90	.6	24.04
.7	72.99	.7	48.31	.7	36.10	.7	28.82	.7	23.98
.8	72.46	.8	48.08	.8	35.97	.8	28.74	.8	23.92
.9	71.94	.9	47.85	.9	35.84	.9	28.65	.9	23.87

FIGURE 14.—THE DRAPER CO.'S TABLE.

Table for numbering Cotton Yarn by the weight in grains of 120 yards or 1 skein.

120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.
42.	23.81	**49.**	20.41	**56.**	17.86	**63.**	15.87	**70.**	14.29
.1	23.75	.1	20.37	.1	17.83	.1	15.85	.1	14.27
.2	23.70	.2	20.33	.2	17.79	.2	15.83	.2	14.25
.3	23.64	.3	20.28	.3	17.76	.3	15.80	.3	14.22
.4	23.58	.4	20.24	.4	17.73	.4	15.77	.4	14.20
.5	23.53	.5	20.20	.5	17.70	.5	15.75	.5	14.18
.6	23.47	.6	20.16	.6	17.67	.6	15.72	.6	14.16
.7	23.42	.7	20.12	.7	17.64	.7	15.70	.7	14.14
.8	23.36	.8	20.08	.8	17.61	.8	15.67	.8	14.12
.9	23.31	.9	20.04	.9	17.57	.9	15.65	.9	14.10
43.	23.26	**50.**	20.00	**57.**	17.54	**64.**	15.62	**71.**	14.08
.1	23.20	.1	19.96	.1	17.51	.1	15.60	.1	14.06
.2	23.15	.2	19.92	.2	17.48	.2	15.58	.2	14.04
.3	23.09	.3	19.88	.3	17.45	.3	15.55	.3	14.03
.4	23.04	.4	19.84	.4	17.42	.4	15.53	.4	14.01
.5	22.99	.5	19.80	.5	17.39	.5	15.50	.5	13.99
.6	22.94	.6	19.76	.6	17.36	.6	15.48	.6	13.97
.7	22.88	.7	19.72	.7	17.33	.7	15.46	.7	13.95
.8	22.83	.8	19.69	.8	17.30	.8	15.43	.8	13.93
.9	22.78	.9	19.65	.9	17.27	.9	15.41	.9	13.91
44.	22.73	**51.**	19.61	**58.**	17.24	**65.**	15.38	**72.**	13.89
.1	22.68	.1	19.57	.1	17.21	.1	15.36	.1	13.87
.2	22.62	.2	19.53	.2	17.18	.2	15.34	.2	13.85
.3	22.57	.3	19.49	.3	17.15	.3	15.31	.3	13.83
.4	22.52	.4	19.46	.4	17.12	.4	15.29	.4	13.81
.5	22.47	.5	19.42	.5	17.09	.5	15.27	.5	13.79
.6	22.42	.6	19.38	.6	17.06	.6	15.24	.6	13.77
.7	22.37	.7	19.34	.7	17.04	.7	15.22	.7	13.76
.8	22.32	.8	19.31	.8	17.01	.8	15.20	.8	13.74
.9	22.27	.9	19.27	.9	16.98	.9	15.17	.9	13.72
45.	22.22	**52.**	19.23	**59.**	16.95	**66.**	15.15	**73.**	13.70
.1	22.17	.1	19.19	.1	16.92	.1	15.13	.1	13.68
.2	22.12	.2	19.16	.2	16.89	.2	15.11	.2	13.66
.3	22.08	.3	19.12	.3	16.86	.3	15.08	.3	13.64
.4	22.03	.4	19.08	.4	16.84	.4	15.06	.4	13.62
.5	21.98	.5	19.05	.5	16.81	.5	15.04	.5	13.61
.6	21.93	.6	19.01	.6	16.78	.6	15.02	.6	13.59
.7	21.88	.7	18.98	.7	16.75	.7	14.99	.7	13.57
.8	21.83	.8	18.94	.8	16.72	.8	14.97	.8	13.55
.9	21.79	.9	18.90	.9	16.69	.9	14.95	.9	13.53
46.	21.74	**53.**	18.87	**60.**	16.67	**67.**	14.93	**74.**	13.51
.1	21.69	.1	18.83	.1	16.64	.1	14.90	.1	13.50
.2	21.65	.2	18.80	.2	16.61	.2	14.88	.2	13.48
.3	21.60	.3	18.76	.3	16.58	.3	14.86	.3	13.46
.4	21.55	.4	18.73	.4	16.56	.4	14.84	.4	13.44
.5	21.51	.5	18.69	.5	16.53	.5	14.81	.5	13.42
.6	21.46	.6	18.66	.6	16.50	.6	14.79	.6	13.40
.7	21.41	.7	18.62	.7	16.47	.7	14.77	.7	13.39
.8	21.37	.8	18.59	.8	16.45	.8	14.75	.8	13.37
.9	21.32	.9	18.55	.9	16.42	.9	14.73	.9	13.35
47.	21.28	**54.**	18.52	**61.**	16.39	**68.**	14.71	**75.**	13.33
.1	21.23	.1	18.48	.1	16.37	.1	14.68	.1	13.32
.2	21.19	.2	18.45	.2	16.34	.2	14.66	.2	13.30
.3	21.14	.3	18.42	.3	16.31	.3	14.64	.3	13.28
.4	21.10	.4	18.38	.4	16.29	.4	14.62	.4	13.26
.5	21.05	.5	18.35	.5	16.26	.5	14.60	.5	13.25
.6	21.01	.6	18.32	.6	16.23	.6	14.58	.6	13.23
.7	20.96	.7	18.28	.7	16.21	.7	14.56	.7	13.21
.8	20.92	.8	18.25	.8	16.19	.8	14.53	.8	13.19
.9	20.88	.9	18.21	.9	16.16	.9	14.51	.9	13.18
48.	20.83	**55.**	18.18	**62.**	16.13	**69.**	14.49	**76.**	13.16
.1	20.79	.1	18.15	.1	16.10	.1	14.47	.1	13.14
.2	20.75	.2	18.12	.2	16.08	.2	14.45	.2	13.12
.3	20.70	.3	18.08	.3	16.05	.3	14.43	.3	13.11
.4	20.66	.4	18.05	.4	16.03	.4	14.41	.4	13.09
.5	20.62	.5	18.02	.5	16.00	.5	14.39	.5	13.07
.6	20.57	.6	17.99	.6	15.97	.6	14.37	.6	13.05
.7	20.53	.7	17.95	.7	15.95	.7	14.35	.7	13.04
.8	20.49	.8	17.92	.8	15.92	.8	14.33	.8	13.02
.9	20.45	.9	17.89	.9	15.90	.9	14.31	.9	13.00

FIGURE 14.— CONTINUED.

Table for numbering Cotton Yarn by the weight in grains of 120 yards or 1 skein.

120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.
77.	12.99	**84.**	11.90	**91.**	10.99	**98.**	10.20	**105.**	9.52
.1	12.97	.1	11.89	.1	10.98	.1	10.19	.1	9.51
.2	12.95	.2	11.88	.2	10.96	.2	10.18	.2	9.51
.3	12.94	.3	11.86	.3	10.95	.3	10.17	.3	9.50
.4	12.92	.4	11.85	.4	10.94	.4	10.16	.4	9.49
.5	12.90	.5	11.83	.5	10.93	.5	10.15	.5	9.48
.6	12.89	.6	11.82	.6	10.92	.6	10.14	.6	9.47
.7	12.87	.7	11.81	.7	10.91	.7	10.13	.7	9.46
.8	12.85	.8	11.79	.8	10.89	.8	10.12	.8	9.45
.9	12.84	.9	11.78	.9	10.88	.9	10.11	.9	9.44
78.	12.82	**85.**	11.76	**92.**	10.87	**99.**	10.10	**106.**	9.43
.1	12.80	.1	11.75	.1	10.86	.1	10.09	.1	9.43
.2	12.79	.2	11.74	.2	10.85	.2	10.08	.2	9.42
.3	12.77	.3	11.72	.3	10.83	.3	10.07	.3	9.41
.4	12.76	.4	11.71	.4	10.82	.4	10.06	.4	9.40
.5	12.74	.5	11.70	.5	10.81	.5	10.05	.5	9.39
.6	12.72	.6	11.68	.6	10.80	.6	10.04	.6	9.38
.7	12.71	.7	11.67	.7	10.79	.7	10.03	.7	9.37
.8	12.69	.8	11.66	.8	10.78	.8	10.02	.8	9.36
.9	12.67	.9	11.64	.9	10.76	.9	10.01	.9	9.35
79.	12.66	**86.**	11.63	**93.**	10.75	**100.**	10.00	**107.**	9.35
.1	12.64	.1	11.61	.1	10.74	.1	9.99	.1	9.34
.2	12.63	.2	11.60	.2	10.73	.2	9.98	.2	9.33
.3	12.61	.3	11.59	.3	10.72	.3	9.97	.3	9.32
.4	12.59	.4	11.57	.4	10.71	.4	9.96	.4	9.31
.5	12.58	.5	11.56	.5	10.70	.5	9.95	.5	9.30
.6	12.56	.6	11.55	.6	10.68	.6	9.94	.6	9.29
.7	12.55	.7	11.53	.7	10.67	.7	9.93	.7	9.29
.8	12.53	.8	11.52	.8	10.66	.8	9.92	.8	9.28
.9	12.52	.9	11.51	.9	10.65	.9	9.91	.9	9.27
80.	12.50	**87.**	11.49	**94.**	10.64	**101.**	9.90	**108.**	9.26
.1	12.48	.1	11.48	.1	10.63	.1	9.89	.1	9.25
.2	12.47	.2	11.47	.2	10.62	.2	9.88	.2	9.24
.3	12.45	.3	11.45	.3	10.60	.3	9.87	.3	9.23
.4	12.44	.4	11.44	.4	10.59	.4	9.86	.4	9.23
.5	12.42	.5	11.43	.5	10.58	.5	9.85	.5	9.22
.6	12.41	.6	11.42	.6	10.57	.6	9.84	.6	9.21
.7	12.39	.7	11.40	.7	10.56	.7	9.83	.7	9.20
.8	12.38	.8	11.39	.8	10.55	.8	9.82	.8	9.19
.9	12.36	.9	11.38	.9	10.54	.9	9.81	.9	9.18
81.	12.35	**88.**	11.36	**95.**	10.53	**102.**	9.80	**109.**	9.17
.1	12.33	.1	11.35	.1	10.52	.1	9.79	.2	9.16
.2	12.32	.2	11.34	.2	10.50	.2	9.78	.4	9.14
.3	12.30	.3	11.33	.3	10.49	.3	9.78	.6	9.12
.4	12.29	.4	11.31	.4	10.48	.4	9.77	.8	9.11
.5	12.27	.5	11.30	.5	10.47	.5	9.76	**110.**	9.09
.6	12.25	.6	11.29	.6	10.46	.6	9.75	.2	9.07
.7	12.24	.7	11.27	.7	10.45	.7	9.74	.4	9.06
.8	12.22	.8	11.26	.8	10.44	.8	9.73	.6	9.04
.9	12.21	.9	11.25	.9	10.43	.9	9.72	.8	9.03
82.	12.20	**89.**	11.24	**96.**	10.42	**103.**	9.71	**111.**	9.01
.1	12.18	.1	11.22	.1	10.41	.1	9.70	.2	8.99
.2	12.17	.2	11.21	.2	10.40	.2	9.69	.4	8.98
.3	12.15	.3	11.20	.3	10.38	.3	9.68	.6	8.96
.4	12.14	.4	11.19	.4	10.37	.4	9.67	.8	8.94
.5	12.12	.5	11.17	.5	10.36	.5	9.66	**112.**	8.93
.6	12.11	.6	11.16	.6	10.35	.6	9.65	.2	8.91
.7	12.09	.7	11.15	.7	10.34	.7	9.64	.4	8.90
.8	12.08	.8	11.14	.8	10.33	.8	9.63	.6	8.88
.9	12.06	.9	11.12	.9	10.32	.9	9.62	.8	8.87
83.	12.05	**90.**	11.11	**97.**	10.31	**104.**	9.62	**113.**	8.85
.1	12.03	.1	11.10	.1	10.30	.1	9.61	.2	8.83
.2	12.02	.2	11.09	.2	10.29	.2	9.60	.4	8.82
.3	12.00	.3	11.07	.3	10.28	.3	9.59	.6	8.80
.4	11.99	.4	11.06	.4	10.27	.4	9.58	.8	8.79
.5	11.98	.5	11.05	.5	10.26	.5	9.57	**114.**	8.77
.6	11.96	.6	11.04	.6	10.25	.6	9.56	.2	8.76
.7	11.95	.7	11.03	.7	10.24	.7	9.55	.4	8.74
.8	11.93	.8	11.01	.8	10.22	.8	9.54	.6	8.73
.9	11.92	.9	11.00	.9	10.21	.9	9.53	.8	8.71

FIGURE 14.—CONTINUED.

Table for numbering Cotton Yarn by the weight in grains of 120 yards or 1 skein.

120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn.	120yds. weigh grains.	Number of Yarn	120yds. weigh grains.	Number of Yarn.
115.	8.70	140.	7.14	180.	5.56	250.	4.00	400.	2.50
.2	8.68	.5	7.12	181.	5.52	252.	3.97	405.	2.47
.4	8.67	141.	7.09	182.	5.49	254.	3.94	410.	2.44
.6	8.65	.5	7.07	183.	5.46	256.	3.91	415.	2.41
.8	8.64	142.	7.04	184.	5.43	258.	3.88	420.	2.38
116.	8.62	.5	7.02	185.	5.41	260.	3.85	425.	2.35
.2	8.61	143.	6.99	186.	5.38	262.	3.82	430.	2.33
.4	8.59	.5	6.97	187.	5.35	264.	3.79	435.	2.30
.6	8.58	144.	6.94	188.	5.32	266.	3.76	440.	2.27
.8	8.56	.5	6.92	189.	5.29	268.	3.73	445.	2.25
117.	8.55	145.	6.90	190.	5.26	270.	3.70	450.	2.22
.2	8.53	.5	6.87	191.	5.24	272.	3.68	455.	2.20
.4	8.52	146.	6.85	192.	5.21	274.	3.65	460.	2.17
.6	8.50	.5	6.83	193.	5.18	276.	3.62	465.	2.15
.8	8.49	147.	6.80	194.	5.15	278.	3.60	470.	2.13
118.	8.47	.5	6.78	195.	5.13	280.	3.57	475.	2.11
.2	8.46	148.	6.76	196.	5.10	282.	3.55	480.	2.08
.4	8.45	.5	6.73	197.	5.08	284.	3.52	485.	2.06
.6	8.43	149.	6.71	198.	5.05	286.	3.50	490.	2.04
.8	8.42	.5	6.69	199.	5.03	288.	3.47	495.	2.02
119.	8.40	150.	6.67	200.	5.00	290.	3.45	500.	2.00
.2	8.39	.5	6.64	201.	4.98	292.	3.42	505.	1.98
.4	8.38	151.	6.62	202.	4.95	294.	3.40	510.	1.96
.6	8.36	.5	6.60	203.	4.93	296.	3.38	515.	1.94
.8	8.35	152.	6.58	204.	4.90	298.	3.36	520.	1.92
120.	8.33	.5	6.56	205.	4.88	300.	3.33	525.	1.90
.2	8.32	153.	6.54	206.	4.85	302.	3.31	530.	1.89
.4	8.31	.5	6.51	207.	4.83	304.	3.29	535.	1.87
.6	8.29	154.	6.49	208.	4.81	306.	3.27	540.	1.85
.8	8.28	.5	6.47	209.	4.78	308.	3.25	545.	1.83
121.	8.26	155.	6.45	210.	4.76	310.	3.23	550.	1.82
.4	8.24	.5	6.43	211.	4.74	312.	3.21	555.	1.80
.6	8.22	156.	6.41	212.	4.72	314.	3.18	560.	1.79
.8	8.21	.5	6.39	213.	4.69	316.	3.17	565.	1.77
122.	8.20	157.	6.37	214.	4.67	318.	3.14	570.	1.75
.5	8.16	.5	6.35	215.	4.65	320.	3.12	575.	1.74
123.	8.13	158.	6.33	216.	4.63	322.	3.11	580.	1.72
.5	8.10	.5	6.31	217.	4.61	324.	3.09	585.	1.71
124.	8.06	159.	6.29	218.	4.59	326.	3.07	590.	1.69
.5	8.03	.5	6.27	219.	4.57	328.	3.05	595.	1.68
125.	8.00	160.	6.25	220.	4.55	330.	3.03	600.	1.67
.5	7.97	.5	6.23	221.	4.52	332.	3.01	610.	1.64
126.	7.94	161.	6.21	222.	4.50	334.	2.99	620.	1.61
.5	7.91	.5	6.19	223.	4.48	336.	2.98	630.	1.59
127.	7.87	162.	6.17	224.	4.46	338.	2.96	640.	1.56
.5	7.84	.5	6.15	225.	4.44	340.	2.94	650.	1.54
128.	7.81	163.	6.13	226.	4.42	342.	2.92	660.	1.52
.5	7.78	.5	6.12	227.	4.41	344.	2.91	670.	1.49
129.	7.75	164.	6.10	228.	4.39	346.	2.89	680.	1.47
.5	7.72	.5	6.08	229.	4.37	348.	2.87	690.	1.45
130.	7.69	165.	6.06	230.	4.35	350.	2.86	700.	1.43
.5	7.66	.5	6.04	231.	4.33	352.	2.84	710.	1.41
131.	7.63	166.	6.02	232.	4.31	354.	2.82	720.	1.39
.5	7.60	.5	6.01	233.	4.29	356.	2.81	730.	1.37
132.	7.58	167.	5.99	234.	4.27	358.	2.79	740.	1.35
.5	7.55	.5	5.97	235.	4.26	360.	2.78	750.	1.33
133.	7.52	168.	5.95	236.	4.24	362.	2.76	760.	1.32
.5	7.49	.5	5.93	237.	4.22	364.	2.75	770.	1.30
134.	7.46	169.	5.92	238.	4.20	366.	2.73	780.	1.28
.5	7.43	.5	5.90	239.	4.18	368.	2.72	790.	1.27
135.	7.41	170.	5.88	240.	4.17	370.	2.70	800.	1.25
.5	7.38	171.	5.85	241.	4.15	372.	2.69	820.	1.22
136.	7.35	172.	5.81	242.	4.13	374.	2.67	840.	1.19
.5	7.33	173.	5.78	243.	4.12	376.	2.66	860.	1.16
137.	7.30	174.	5.75	244.	4.10	378.	2.65	880.	1.14
.5	7.27	175.	5.71	245.	4.08	380.	2.63	900.	1.11
138.	7.25	176.	5.68	246.	4.07	382.	2.62	925.	1.08
.5	7.22	177.	5.65	247.	4.05	385.	2.60	950.	1.05
139.	7.19	178.	5.62	248.	4.03	390.	2.56	975.	1.03
.5	7.17	179.	5.59	249.	4.02	395.	2.53	1000.	1.00

FIGURE 14.—CONTINUED.

COUNTS				COUNTS			
Grains	Single yarn	2 fold yarn	3 fold yarn	Grains	Single yarn	2 fold yarn	3 fold yarn
100	10000	20000	30000	200	50000	10000	15000
1	99009	19801	29702	1	49751	99502	14925
2	98039	19607	29411	2	49504	99009	14851
3	97087	19417	29126	3	49261	98522	14778
4	96153	19230	28846	4	49019	98039	14705
5	95238	19047	28571	5	48780	97560	14634
6	94339	18867	28301	6	48543	97087	14563
7	93457	18691	28037	7	48309	96618	14492
8	92592	18518	27777	8	48076	96153	14423
9	91743	18348	27522	9	47846	95693	14354
110	90909	18181	27272	210	47619	95238	14285
1	90090	18018	27027	1	47393	94786	14218
2	89285	17857	26785	2	47169	94339	14150
3	88495	17699	26548	3	46948	93896	14084
4	87719	17543	26315	4	46728	93457	14018
5	86956	17391	26086	5	46511	93023	13953
6	86206	17241	25862	6	46296	92592	13888
7	85470	17094	25641	7	46082	92165	13824
8	84745	16949	25423	8	45871	91743	13761
9	84033	16806	25210	9	45662	91324	13698

FIGURE 15.—PORTION OF WAEFFLER'S WRAPPING TABLE.

Dr. HERZFELD in his work on the Technical Testing of Yarns and Fabrics, gives the following table of variations above and below reputed count, but it does not appear that either these allowances or any other are in general use, although some manufacturers insist on having their yarn delivered on the fine side of the reputed count.

Table of Allowances.

Waste Yarn,	1 to 6, including imitation,	4.0	per cent.
	1 " 10,	2.5	"
Cotton,	11 " 20,	2.0	"
	21 " 40,	2.5	"
Above	40,	3.0	"

and other percentages are given for other fibres.

One sometimes hears the expression "one count above or below will pass." The effect of a slight variation in count is clearly shown in the following example: —

1000 Looms.—42″ in reed; 68 picks per inch; reputed count 40's fillling at 36 cts.; actual average count 39.5; 180 pks. per minute; 60 hours per week; 50 full weeks per year; 80 % effective production.

$$\frac{\overset{\text{Looms.}}{1000} \times \overset{\text{Pks.}}{180} \times \overset{\text{Mins.}}{60} \times \overset{\text{Hrs.}}{60} \times \overset{\text{Weeks.}}{50} \times \overset{\text{Pr Ct.}}{80} \times \overset{\text{Pks.}}{68} \times \overset{\text{Ins.}}{42} \times \overset{\text{Cts.}}{36}}{36 \times 68 \times 100 \times 840 \times 40 \times 100} = \$324{,}000$$

$$\frac{1000 \times 180 \times 60 \times 60 \times 50 \times 80 \times 68 \times 42 \times 36}{36 \times 68 \times 100 \times 840 \times 39.5 \times 100} = \$328{,}101$$

$$\$328{,}101 - \$324{,}000 = \mathbf{\$4{,}101\ Loss.}$$

These may appear startling figures, but there does not appear to be any reason for doubting their accuracy, and they show how necessary it is for a manufacturer to keep a very strict eye on the count of the material as it comes into his mill.

Testing the Count from a Small Sample of Cloth.— When a small sample of cloth is submitted to a manufacturer, the count of materials has to be ascertained, and there are several methods of doing this. Perhaps one of the commonest plans adopted is by comparison with known counts of yarn, usually by twisting a certain number of threads from known count and sample together. In the hands of an expert this is probably sufficiently reliable for all practical purposes, but it requires some skill and experience before the results obtained in this manner may be relied upon. In addition, when this plan is adopted it is necessary to have a fairly wide range of counts and spun from various kinds of cotton, as the test is one of touch.

Now while there is no desire to cast any doubts on the general accuracy of this method, attention should be drawn to the fact, that count is a matter of weight for a given length, and not a question of thickness of material. Under these circumstances it would appear that the correct method is to weigh the yarns and calculate the count from the weight.

There are a number of specially designed balances for ascertaining the count of short lengths of yarn, all of which however may be classed in two groups, *A*, those which are based on the principle of length units per weight unit, and *B*, those in which a given length of yarn causes a pointer to indicate the count on a graduated scale; each system has advantages and disadvantages, but if a special balance has to be used, preference should be given to the latter type, because in most cases a greater length of material is tested, they allow of multiples and measures of the stated length being used, and they are nearly all provided with a standard weight by which they may be calibrated. The former type may be used with advantage when only very short lengths are available.

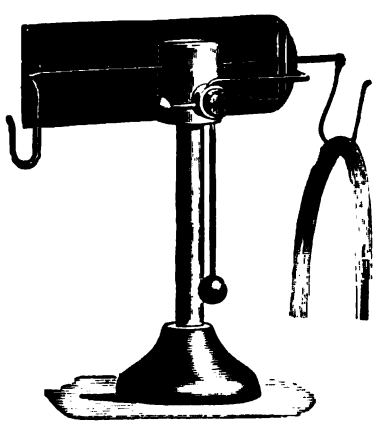


FIGURE 16.—STAUB'S BALANCE.

Figure 16 shows a drawing of a balance belonging to the first type, and is known as Staub's balance. It consists of a light wire beam, at each end of which there is a hook, the one on the left representing the unit of weight, and that on the right being used to carry the short lengths of yarn being tested. Small brass templates are supplied with the apparatus, each of which bears the same relation to the length unit that the left hand hook bears to the weight unit. The number of threads which balance the beam indicate the count.

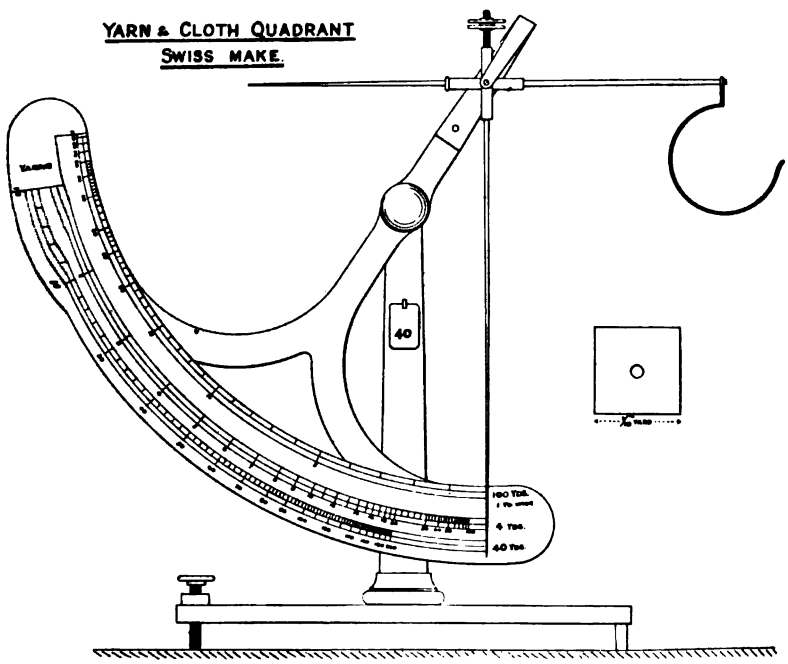


FIGURE 17.

Figure 17 illustrates a Swiss balance belonging to the second class. This apparatus can be used for several purposes. First, for testing the count of four yards of yarn; second, the count of forty yards of yarn; and third, the weight of one hundred square yards of cloth. Two templates are supplied with this balance, one of which is one-tenth of a yard square, and the other one-half a yard long. The first is intended when only small pieces of cloth are available, and for cutting cloth to get the weight, forty threads are cut to length of template when the count is shown on 4-yard scale, whilst the second is used when larger pieces are available, in which case eighty lengths of one-half yard each are cut and put on the hook, when the count is indicated on the 40-yard scale.

Whilst both these types of apparatus are useful, a well-constructed chemical balance is, after all, the best and the most

reliable. It can be used for all kinds of fine weighing, and for both long and short lengths of yarn. All that is required is a small series of templates representing different weight units. For example, suppose one grain is taken as the weight unit, then the length unit will be $(840 \times 36) \div 7000 = 4.32''$, and if a template is cut exactly to this size, the number of threads of this length which balance the grain weight will equal the count. Other weights and other sizes of templates will readily suggest themselves.

Method of Measuring Short Lengths of Yarn from Cloth.—Seeing that the material to be weighed is at most only a small quantity, it is of great importance that it should be carefully measured. It is well known that the bending of the threads of warp and weft due to weaving varies in different fabrics, and it is also very clear that in order to get the right length of yarn for weighing, the bent yarn must be straightened out. From some experience in this work it has been found that the threads can be cut to the proper length better out of the fabric than in the texture. The "buckle" should be removed by passing the threads between the finger and thumb, but without stretching.

This point has been specially mentioned because the makers of some of the small balances say that the *cloth* should be cut to the template and then the prescribed number taken out and weighed. Obviously this is not correct, as no account is taken of the threads being longer out of, than in the cloth.

Testing for Strength and Stretch to Breaking.—Having dwelt at some length on matters relating to the count of yarn, attention is now directed to the various methods by which the tensile strength of a thread is determined.

The strength and elasticity of a thread are two of its most important features, as during the process of weaving these properties are often severely taxed, and if they fall below the necessary standard, much trouble is caused and the quality and product of the loom is often materially reduced.

There are various means employed in testing yarn for strength and elasticity. For example, men of much experience can

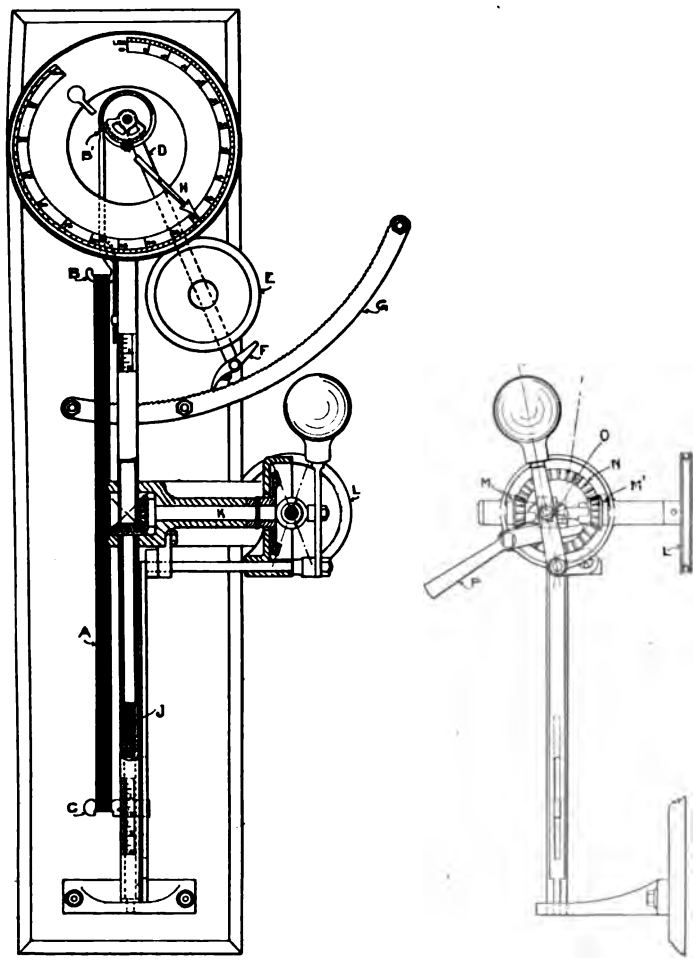


FIGURE 18.— MECHANICAL LEA TESTER.

gauge a yarn pretty accurately by breaking the material in the hands, but this faculty is possessed by few, and can only be acquired by long experience.

Again, the behavior of the material during its passage through the process of winding and warping is often taken as a criterion of its quality, and it may be admitted that this is a satisfactory

test, because if it winds and warps indifferently, it is not likely that its weaving qualities will be good. One drawback to this plan is that the observations cannot be made until the yarn is in work, and if anything is wrong, it is not easily dealt with at this stage. These tests may be classed as empirical, and and not in any sense scientific, nor is it possible to keep any records. The following give some of the various forms of testing yarns for strength.

Lea Testing.—By far the most common form of strength testing at present in use is lea testing, which consists of breaking one lea (120 yards) on a specially constructed machine which indicates the breaking load in pounds, and the stretch to breaking in inches. Most makers of testing machinery construct a lea tester, and they differ only in minor details. Some of the machines are worked manually, whilst others are driven mechanically; the latter plan is by far the best, as it is then possible to get more regular and reliable results. One form of a mechanically worked lea tester is shown at Figure 18.

The machine is very similar in its main features to those commonly used for lea testing, probably the only difference being in the reversing motion, which automatically brings the moving hook *G* back to the starting place after the completion of a test. Provision is also shown for observing the amount of elongation up to the point of breaking. In some machines the latter is obtained by causing a plate marked in divisions of one inch to travel downwards at the same rate as the hook *G*, whilst a pointer overhanging the plate is attached to the upper hook *B*, and the elongation can be readily observed at the moment of the fracture of the lea.

Figures 2 and 3 show a series of lea breaks taken from two cops of 46s mule twist, the count of the yarn for each lea is also given underneath, and it may be interesting to note that the diagrams as might be expected follow each other closely, that is, as the count goes down the break rises.

Now, it would appear that the only result recorded on a lea tester is the aggregate breaking load of 80 double threads or

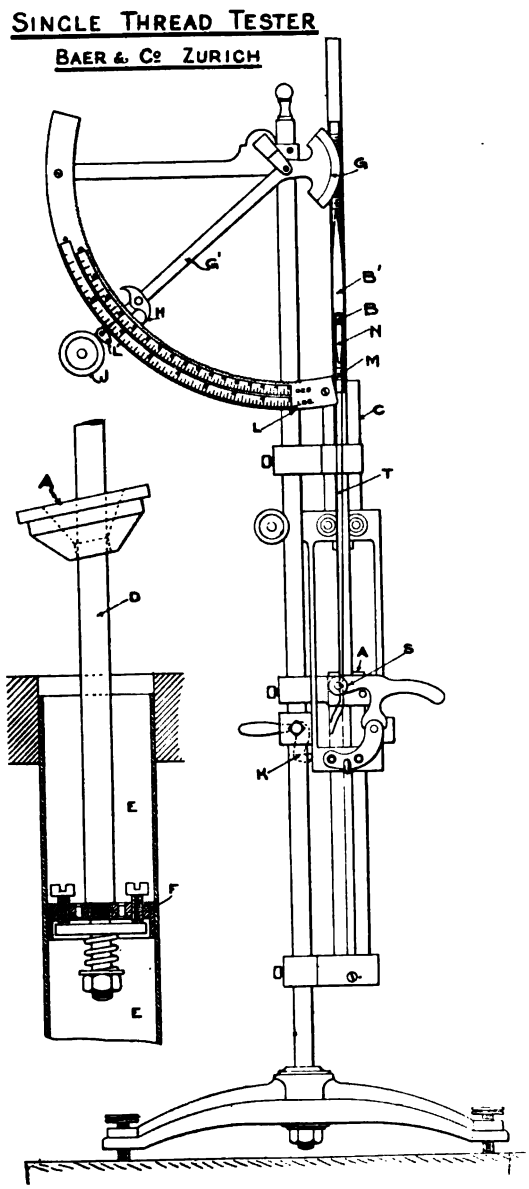


FIGURE 19.

something approaching that. This may be useful for some purposes, and indeed it is practically the only recognized strength test at present, but what particular value has it for the manufacturer, seeing that when the threads are put into the loom each one has to bear its own share of the tension necessary for the production of the fabric? Of what use is the knowledge that 80 threads of a certain yarn will bear a given weight? What is likely to be of use to the manufacturer is some detailed statement of the breaking strength of a number of single threads along with the average as well, but first and foremost a statement, either graphically or in figures, which will disclose how that average is made up. It is much better to have a yarn which is regular in strength even if the average is slightly lower than another yarn whose average has been raised by the presence of a few abnormally strong threads, which are of no particular value to the warp, and which will certainly not assist the weak ones when they are in the loom.

Single and Double Thread Strength Testers. — A consideration of the foregoing view of the situation has led to the introduction of a number of machines for testing the strength and stretch to breaking of single and double threads.

Some of these machines are elaborate in construction and are capable of giving very accurate results, but they are costly, and consequently not readily available for ordinary warehouse use. Such a machine is one made by SCHOPPER. Other machines are clumsy, and not sufficiently accurate for the work to be done.

Others again are handy, and made to bear the ordinary wear and tear of warehouse work, besides having the merit of moderate cost. Such a machine is shown at Figure 19, which is a front view of a single or double thread testing machine made by Henry Baer & Co., of Zurich, Switzerland, with a detail showing how the speed of the plunger is regulated.

The action of the machine is somewhat as follows: A thread is looped over a small pulley at *B*, and the two ends are clipped by a screw clip at *S*. This is attached to a frame which, when the apparatus is at rest, is held up by a catch *K*. This frame

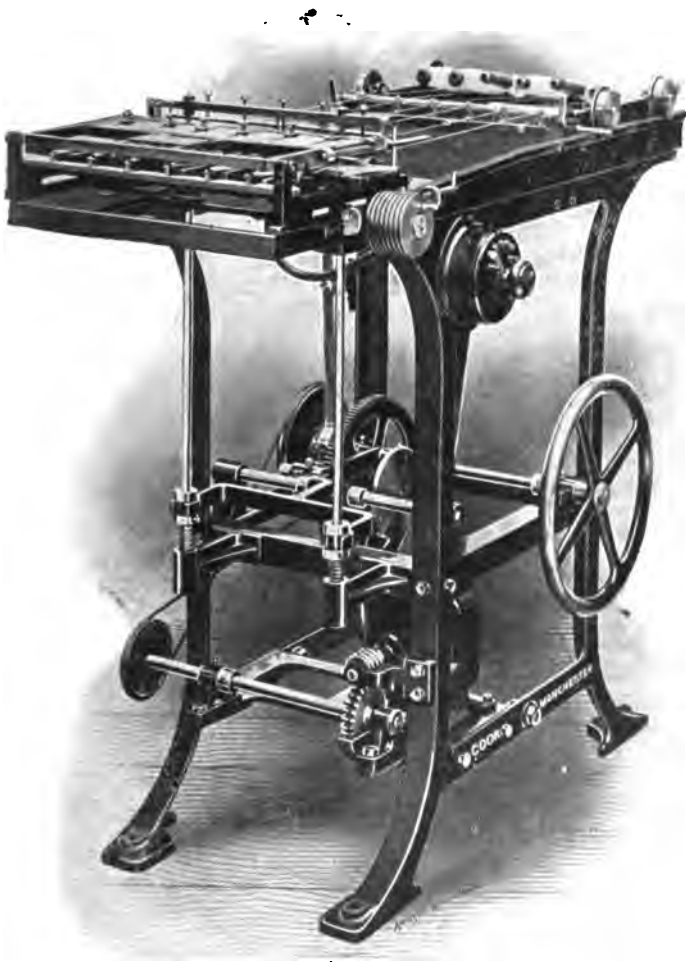


FIGURE 20.—MOSCROP TESTER.

carries a perforated plunger *F* working in an oil cylinder *E*, the upper part *D* of the plunger terminates in a lead weight covered with brass. The quadrant and arm *G. G.'* carry a pair of catches and a weight *J*, which latter supplies the necessary strain required to break the yarn. When a test has to be made the arm *G'* is brought down, and a square catch *L'* takes into the detent *L* until the thread is placed in position as already mentioned. *L'* is now lowered, and catch *K* lifted. This allows the frame to descend and put strain on the yarn, the weight *J* is slowly raised until the thread breaks when the load is shown on the quadrant. Whilst the frame descends, and the thread is still unbroken, the graduated scale *M* descends at the same speed, but as soon as the thread breaks the scale is released and stops; and the elongation is shown on the scale by the pointer *N*, which is connected with *B*, and consequently comes down at the same rate.

The machines are provided with two scales on the quadrant, one having a range of sixteen ounces, and the other a range of four pounds; for the finer yarns, the front portion of the weight is removed, when the break is read on the upper or sixteen ounce scale. The speed of the plunger is set to one inch in five seconds by regulating the aperture through which the oil flows.

In practice a double thread test is found most convenient, and a large number of tests can be made in a short time by a girl or a youth. The length of yarn tested is 18 inches for single and 36 inches for double thread tests.

There are a good many of these machines at work, they are reliable and easy to manipulate. All the double thread tests shown on the diagrams have been made by one of these machines.

Automatic Single Thread Tester, Cook & Co., Manchester, (Moscrop's Patent.) This machine recently introduced belongs to the automatic type, and is very ingenious and useful. A general view of the machine is shown at Figure 20.

The action of the machine may be gathered from the follow-

ing description. The cops or bobbins are placed on skewers mounted upon a frame having a traversing motion, each thread is passed through the tensioning hooks and eyes, and between a clip. When the machine is started the frame moves forward, and a plate lying underneath the threads rises and lays each thread into the jaws of another series of clips which immediately close. When the frame or carriage has receded about 12″, the clips in the carriage close on the threads, and as the carriage continues its outward movement for about another 4″, strain is put on the threads, the strain distends a series of springs mounted at the rear end of the second set of clips, this distension draws a series of pointers along until the several threads are broken, then the pointers are pressed down into the diagram slip, at the positions to which the pointers have been pulled, and thus a record of the breaking load is made. The broken ends are cleared away from the clips, the pointers pushed back to zero and the whole cycle of movements is repeated about eighty times when the machine is stopped automatically. The record of the breaking strength of the several threads is shown on a punctured slip, and the variations are readily observed.

Different strengths of springs are used for various qualities and counts of yarn.

The only apparently weak part of the machine is the spring, and to eliminate error the greatest possible care is exercised in the selection of the springs.

Records of Tests.—In order to demonstrate the value of double thread testing as a means of determining the quality of the yarn, and with a view to making a comparison with lea testing, a series of graphic diagrams have been prepared, and these are shown at Figures 21 to 24.

Now, seeing that at the present time most people who deal in yarn speak of its strength in pounds per lea, and as these customs are inclined to continue, and if they die at all they die hard, it was thought that it would be interesting to make a comparison between the breaking strength of leas, and the breaking strength of double threads, and if possible to establish a ratio between the two.

In the graphic diagrams shown on Figures 21 to 24 it will be observed that the double threads tests disclose a much greater variation in the strength of the yarn than is shown in the lea tests taken from the same bobbins, the variation in the double thread tests extending from 25 per cent. to 59 per cent., whilst the variation in the lea tests extends from 7.6 per cent. to 31.7 per cent.

A great many tests have been made to determine the actual differences existing in yarns, and from these a few typical examples only are given, but sufficient to demonstrate the superiority of double thread testing over lea testing.

This is a matter of as much importance to spinners as manufacturers, particularly spinners who have a reputation to make or to maintain.

The table, Figure 25, shows the percentage of variation in strength between maximum and minimum in the same yarn from lea and double thread tests, and also in the last column the relation that a double thread bears to a lea break. From this column it will be seen that the ratio between the mean lea break and the mean double thread break is as 100 is to 1.76 approximately, and this figure is substantially the same for both American and English spun yarn.

It is hoped that these investigations which have proved so interesting to the author may prove equally interesting to others and be carried still further.

Thanks are due to the firms who have kindly lent drawings and blocks for Figures 1, 6, 10, 12, 15, 16, 19 and 20 and to those who have supplied a number of samples of yarn for testing. and these are gratefully tendered by the author, who also desires to thank those of his colleagues and students in the Municipal School of Technology, Manchester, who have rendered willing help in various ways.

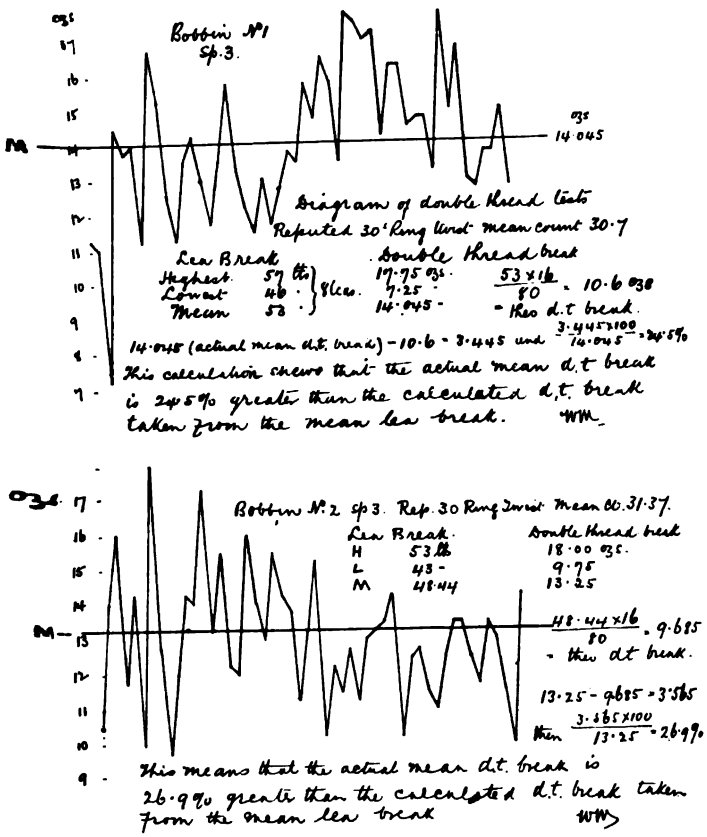

Bobbin No 1
Sp. 3.
Diagram of double thread tests
Reputed 30' Ring twist mean count 30·7
Lea Break
Highest 57 lbs
Lowest 46 ·
Mean 52 ·
8 lcs.
Double thread break
17·75 ozs.
7·25 ·
14·045 ·
53 × 16 / 80 = 10·6 ozs
= Theo d.t break.
14·045 (actual mean d.t. break) − 10·6 = 3·445 and 3·445 × 100 / 14·045 = 24·5%
This calculation shows that the actual mean d.t break is 24·5% greater than the calculated d.t. break taken from the mean lea break.
WM
Bobbin No 2 Sp 3. Rep. 30 Ring twist mean 60.31.37.
Lea Break.
H 53 lbs
L 43 -
M 48·44
Double thread break
18·00 ozs.
9·75
13·25
48·44 × 16 / 80 = 9·685
= theo dt break.
13·25 − 9·685 = 3·565
then 3·565 × 100 / 13·25 = 26·9%
This means that the actual mean d.t. break is 26·9% greater than the calculated d.t. break taken from the mean lea break
WM

FIGURE 21.

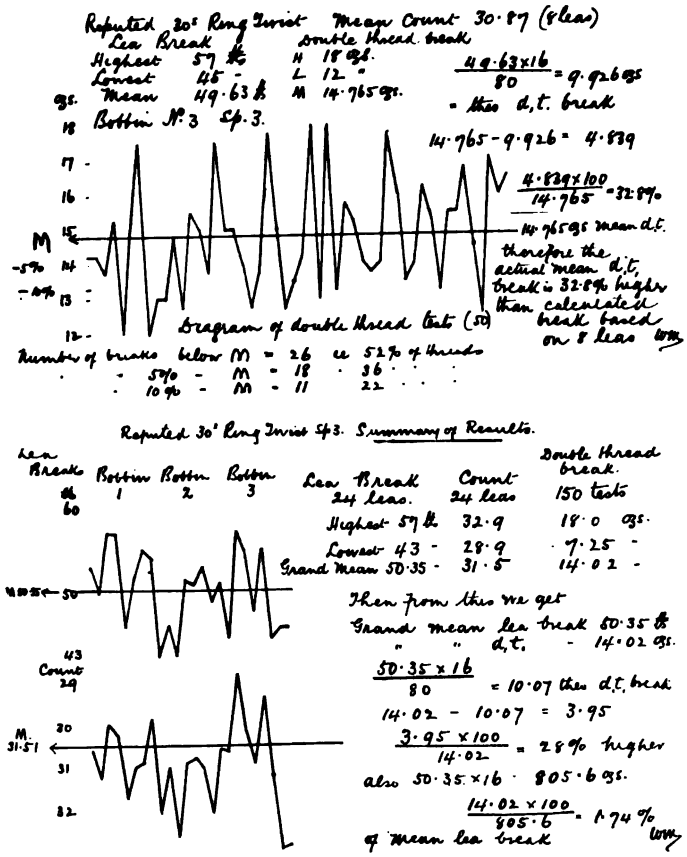

Reputed 30s Ring Twist Mean Count 30·87 (8 leas)
Lea Break
Double thread break
Highest 57 lb
H 18 ozs.
Lowest 45 -
L 12 "
Mean 49·63 lb
M 14·765 ozs.
49·63 x 16 / 80 = 9·926 ozs
= this d.t. break
ozs.
Bottm No. 3 Sp. 3.
14·765 - 9·926 = 4·839
4·839 x 100 / 14·765 = 32·8%
14·765 ozs mean d.t.
M
-5%
-10%
therefore the actual mean d.t. break is 32·8% higher than calculated break based on 8 leas
Diagram of double thread tests (50)
Number of breaks below M = 26 ie 52% of threads
- 5% - M = 18 36
- 10% - M = 11 22
Reputed 30s Ring Twist Sp. 3. Summary of Results.
Lea Breaks
Bottm 1
Bottm 2
Bottm 3
lb
60
50
M 50·35
43
Count 29
30
M. 31·51
31
32
Lea Break 24 leas.
Count 24 leas
Double thread break 150 tests
Highest 57 lb 32·9 18·0 ozs.
Lowest 43 - 28·9 7·25 -
Grand Mean 50·35 - 31·5 14·02 -
Then from this we get
Grand mean lea break 50·35 lb
" " d.t. - 14·02 ozs.
50·35 x 16 / 80 = 10·07 this d.t. break
14·02 - 10·07 = 3·95
3·95 x 100 / 14·02 = 28% higher
also 50·35 x 16 = 805·6 ozs.
14·02 x 100 / 805·6 = 1·74 %
of mean lea break

FIGURE 22.

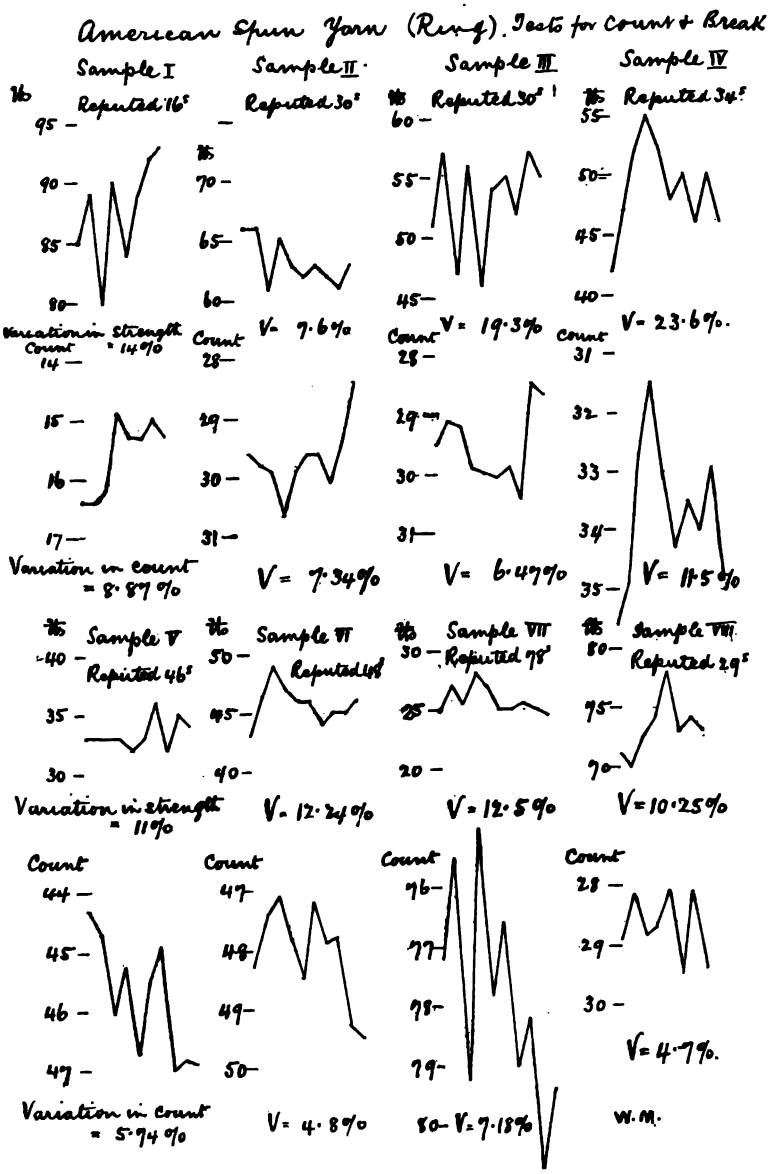
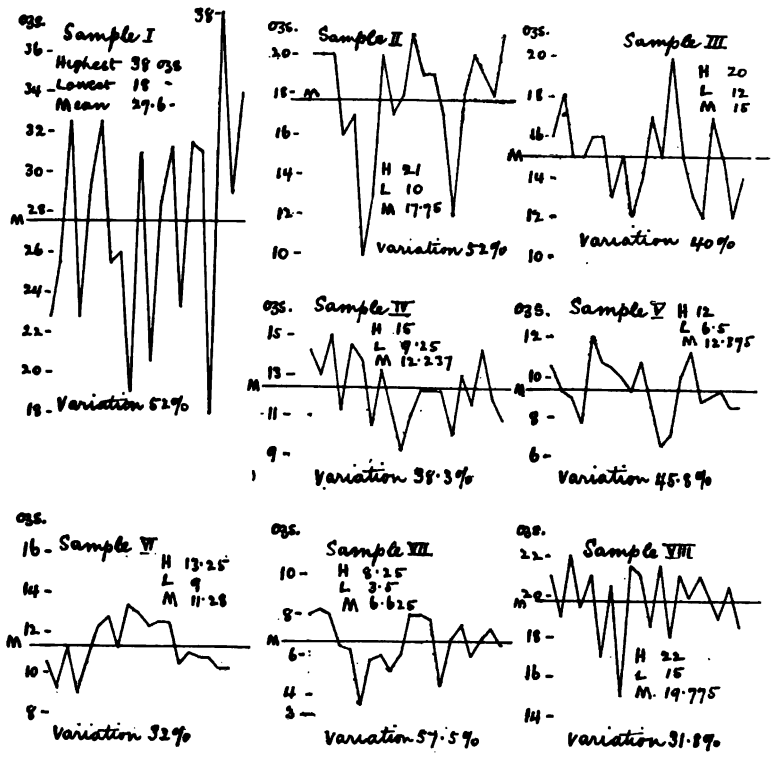

American Spun Yarn (Ring). Tests for Count + Break
Sample I
Reputed 16s
Variation in strength = 14%
Count
Variation in count = 8·87%
Sample II
Reputed 30s
V = 7·6%
Count
V = 7·34%
Sample III
Reputed 30s
V = 19·3%
Count
V = 6·47%
Sample IV
Reputed 34s
V = 23·6%.
Count
V = 11·5%
Sample V
Reputed 46s
Variation in strength = 11%
Count
Variation in count = 5·94%
Sample VI
Reputed 48s
V = 12·24%
Count
V = 4·8%
Sample VII
Reputed 78s
V = 12·5%
Count
80 V = 7·18%
Sample VIII
Reputed 29s
V = 10·25%
Count
V = 4·7%.
W.M.

FIGURE 23.



Diagrams shewing the breaking loads in ounces of 8 samples of American Spun Ring Twist 20 double thread tests from each. W.M.

FIGURE 24.

Sample.		Reputed Count.	VARIATION.		The Per Cent. that a Double Thread Break Bears to a Lea Break.
			Lea Break.	Double Thread Break.	
American	I	16	14 per cent.	52.6 per cent.	1.96 per cent.
"	II	30	7.6 "	52.0 "	1.75 "
"	III	30	19.3 "	40.0 "	1.77 "
"	IV	34	23.6 "	38.3 "	1.56 "
"	V	46	11.0 "	45.8 "	1.76 "
"	VI	48	12.24 "	32.7 "	1.54 "
"	VII	78	12.5 "	57.5 "	1.61 "
"	VIII	29	10.25 "	31.8 "	1.69 "
English	B1	30	19.3 "	59.2 "	1.66 "
"	B2	30	18.9 "	45.0 "	1.68 "
"	B3	30	21.0 "	33.3 "	1.90 "
"	A	32	20.6 "	25.0 "	1.65 "
"	B	32	27.7 "	25.0 "	2.00 "
"	C	32	18.2 "	44.0 "	1.78 "
"	D	32	14.0 "	31.5 "	1.92 "
"	E	32	20.7 "	33.3 "	1.76 "
"	F	32	31.7 "	33.3 "	1.94 "

FIGURE 25.—TABLE OF COMPARISONS.

The PRESIDENT. I understand that Mr. HOGUET has a good deal of testing apparatus of a similar nature in his laboratory. Perhaps he could give us some information.

Mr. ROBERT J. HOGUET. I have not had an opportunity of studying the paper in detail, but I would say that the apparatus described coincides with and comes exactly upon the same lines as our testing apparatus; in fact, several of them that are mentioned here we have in our laboratory in New York. The process that this gentleman speaks of is the English process. We have adopted the French process but the difference is so slight that it is no difference. We arrive at the same result by a little different method. But most of the machines that are mentioned in this paper we have in our own laboratory in New York. We are very happy, as I said before, to test anything for anybody. You can simply put a cop or a bobbin into a preserve jar and send it on to us.

The PRESIDENT. Has anyone else anything to say in regard to this paper? I think Mr. DRAPER has had considerable experience in that line. May we hear from him on that subject?

Mr. GEORGE OTIS DRAPER. Mr. President, regarding this particular machine on which we have the record, I must say my own personal information on that subject is rather lacking because such tests as we have had carried on with that come under the department with which I had no connection during the last few months in which we have been introducing this machine. With regard to the old fashioned system of testing with the ordinary hand or power tester, I have had a good deal of experience. In fact, the breaking strength tables which we now publish were made under my supervision. All that I have to say is to call special attention to the fact that the hand-operated breaking machine is, in my opinion, absolutely and utterly unreliable; place no confidence whatever in a hand-operated strength tester.

The next paper will be upon the subject of The Combing of Short Staple Cotton. Its author is an English mechanical engineer of Manchester, the inventor of the Nasmith Comber and it will be read by this gentleman's representative in this country, Mr. STEPHEN C. LOWE.

Mr. STEPHEN C. LOWE. Mr. President and Gentlemen of the Association. I will not make any apologies for this paper other than to say it is so short that I hope you will listen to it and I think it will be of interest.

THE COMBING OF SHORT STAPLE COTTON.

JOHN W. NASMITH, Manchester, Eng.

The title of this paper suggests at once the necessity for a definition of what is meant by short cotton. When the Heilmann machine first came into use, it was said to be a comber for short fibres, since no attempt had previously been made to comb cotton at all, but only the long wool fibre, and when it came to be used on Egyptian cottons of 1⅜-inch staple, it was thought to be combing the shortest cotton that it would pay to comb, and indeed this would be so, had the Heilmann machine remained the only one. It was the necessity in the hosiery trade of having very regular and very clean yarn of coarse counts, that first suggested the combing of "short cotton," and we may now define what is meant thereby. It is intended to include in the term "short cotton," those classes with staple from ⅝ inch to 1⅛ inches in length.

It may first be shown why the Heilmann is debarred from dealing with such short fibres. Two points stand out clearly. First, the separation of the tuft from the lap is brought about by the contact of the leather detaching roll, not with the fluted segment on the cylinder, but with the steel roll in front, so that between this point of contact and the top comb, there is the full diameter of the leather roll. The diameter of the leather covered detaching roll has been reduced to meet this difficulty to the utmost limit consistent with the necessary rigidity. But this diameter is still much too great to deal with short cotton as defined above, and so the waste is excessive, indeed prohibitive. Secondly, there is the vital question of a piecing, and in the Heilmann comber, it is impossible to get a satisfactory piecing

with stock shorter than 1⅛ inches, and it fails entirely below one inch.

The first effect of a bad piecing on short cotton is the frequent breakage of the slivers on the comber table, causing frequent stoppages, reduction of the already small production of the Heilmann and an excessive amount of waste sliver. The bad piecing cannot be obliterated at the comber draw box, and the result is a weak sliver all through the draw frames with frequent stoppages and large quantities of waste to be returned to the scutching room, after labor has been expended upon it. The weak slivers and consequent frequent piecings at the comber and draw frames, make themselves felt in the form of irregularities in the yarns. From this it will be seen that one of the chief difficulties in connection with the combing of short cotton lies outside the comber itself, and is caused by the weakness of the slivers due to bad piecing.

To obviate these difficulties, the Pinel Lecoeur comber was nvented and made by HETHERINGTON, and it reduced the waste made in combing short cotton and made a fair piecing even with ⅝ inch Surat cotton. The writer erected nearly all the machines of this type that were made for European mills, and most beautiful hosiery yarns of coarse counts were made from ⅝ inch Surat cotton, with about 23 per cent. of waste, which was collected right at the comber into a sliver and passed through draw frame slubber and intermediate, and spun at once into 4's yarn, whilst cloths of excellent qualities were produced from one inch American cotton.

But this machine failed to make the combing of short cotton a commercial success, for the following reasons: —

(1) Its production was not greater than that of a Heilmann, and although it made a better piecing in appearance, the sliver was not amalgamated at the piecing and drawn together, but simply overlaid.

(2) The waste was still too high, rendering the process expensive.

(3) The machine was complicated and difficult to set.

The Nasmith comber is now happily well known, nearly 2,000 being at work, and one of the attributes of this machine is its capability of dealing much more satisfactorily than its predecessors with staples between ⅝ inch and 1⅛ inches, for not only does it produce double the weight per machine, but it renders it possible to comb these short staples without excessive waste, the two essentials to make such combing commercially practicable. In addition to this, it makes a piecing, which, even on these short cottons, is practically perfect.

In all combers except the Nasmith, the piecing consists simply of laying the tips of one lot of fibres over the tails of the previously detached series, the overlap being about ½ inch on long cottons, and with short cottons, no sliver can be made that will hold together along the table. But the nature of the piecing in the Nasmith machine is quite different, there being not only a long overlap much exceeding the length of the staple on the short cottons, but the ends are thoroughly amalgamated by being drawn in whilst the overlap is being made. This does away with the serious difficulty of manipulating the combed slivers at the subsequent operations, and makes such operations quite normal in character, causing neither excessive waste, nor stoppage. A sliver of ¾ inch cotton taken just before entering the draw box on a Nasmith, can be raised from the table and will sustain its own weight for the full length of the table, which provides ocular demonstration of the soundness of the piecing.

In the hosiery trade, the machine has long ago established itself as the best for the purpose, and there is at the present, a growing demand for combed American yarns of medium counts.

A little consideration will show the difficulties in the way of combing short cotton, without taking out too much waste. In Sea Island cotton for instance, neglecting a small percentage of mere fluff, we have all lengths of fibres between ½ inch and two inches, and it is comparatively easy to select, in combing, all those below one inch and comb them out. But in one inch stock, the difference in length between the long and the short fibres is much less, and it becomes increasingly difficult to select only the short, as the difference decreases.

The technical point which renders it possible to comb short cotton on a Nasmith comber without excessive waste, is that the nipper can be brought very close to the nip of the detaching rolls with just space between for the top comb, so that there is only half the diameter of the detaching roll between the top comb and the nipping point of the rolls, instead of the full diameter of leather covered detaching roll, as explained above.

As regards the actual work of the machine, it may be said that 850 pounds of combed sliver of good quality can be produced weekly per machine, on one inch stock, and with waste from 15 per cent. to 20 per cent., according to quality required.

Another point of utility of the Nasmith comber has been recently developed in European mills, namely, the recovery of the good cotton in the strips from the flats of carding engines, and in this connection, the following data may be of interest, and it must be noticed that the yarn made from the combed flat strips, is always much stronger than the carded yarn made from the original cotton.

RECLAMATION PLANT.

Test of 100 pounds of Card Flat Strips.

American (Orleans) Cotton passed through Combined Creighton Opener and Scutcher, Revolving Flat Carding Engine, one head of drawing and made into laps on the Sliver Lap machine preparatory to combing on the Nasmith Comber.

Loss at Combined Opener and Scutcher,	7 pounds, 6 ounces.
Loss at Card,	16 pounds, 2 ounces.
Loss at Comber,	19 pounds, 2 ounces.
Total loss,	42 pounds, 10 ounces.

Total weight of finished Sliver ready to be put up at the third head of drawing,	57 pounds, 6 ounces.

COMPARISON OF COST AND PROFIT.

Value of 1,000 pounds of strips at 2¾d per pound,	£11	9	2	Value of 570.375 pounds of Combed Sliver at 7⅞d per pound,	£18	14	4
WAGES: Blowing room,		2	0	Value of 190.125 pounds of Comber Waste at ¾d pound,		11	10
Carding "		2	0		£19	6	2
Combing "		10	0				
EXPENSES: Incidental,		1	0				
12½ Depreciation and interest on capital outlay including 1 Comber and 1 Lap Machine,		13	5	Less value of 1,000 pounds Strips and working expenses,	£12	17	7
	£12	17	7				

Total Net Profit from 1,000 pound strips which one Nasmith comber will treat in one week of 50 hours under normal conditions, £6 8 7

Test of Cops spun from Combed Flat Strip, as against the ordinary yarn: — Waste made on comber, 24 per cent.

Ordinary yarn.	Yarn from Combed Strip.
Weft cops,	Weft Crops,
Average of eight wrappings,	Average of eight wrappings,
Counts 74¼ pulls 16¼ pounds.	Counts 73¼ pulls, 19 lbs.

Twist Cops (ordinary).	Twist Cops from Combed Strips.
Average of eight wrappings,	Average of eight wrappings,
Counts 63⅝ pulls 22⅛ pounds.	Counts 65 pulls 24½ pounds.

Test of Cops spun from one end of combed strip sliver mixed with seven ordinary ends at the draw frame.

Ordinary Yarn Twist Cops.	Yarn from one end of strip.
	Seven of ordinary sliver,
Average of six wrappings,	Average of six wrappings,
Counts 40.1 pulls 41.8 pounds.	Counts 41.5 pulls 43 pounds.

Mr. STEPHEN C. LOWE. You have before you these figures on a reclamation plant. I will say that these figures are from actual tests in England and can be fully corroborated here.

The PRESIDENT. Has anyone anything to say on this subject?

Mr. ARNOLD B. SANFORD. I would like to ask what is the width of lap, and how many heads to the machine?

Mr. STEPHEN C. LOWE. The machine is made in two sizes. This machine is made in 10½ and 12½ inch laps, six heads to a machine only. This test was made on a 10½ inch lap. These tests are from that size machine; 18 per cent. more is gained by the wider lap, the 12½ over the 10½.

Mr. JOHN A. FERNLEY. Mr. President, I would like to ask the difference between the production of the Nasmith against the Heilmann on the same staple of cotton.

Mr. STEPHEN C. LOWE. I will answer that question, Mr. President, by saying that there are two sizes of Heilmann Combers, having six heads and eight heads. They are made in $8\frac{3}{4}$ and $10\frac{1}{2}$ inch laps. A $10\frac{1}{2}$ inch lap comber, eight heads, produces between 450 and 500 pounds in one mill of my recollection, as against a six head $10\frac{1}{2}$ inch Nasmith, producing between 750 and 800 pounds, doing better work in this respect that the piecing is so much better in the Nasmith than in the Heilman, that the yarn has a smoother and rounder appearance and breaks stronger.

Mr. JOHN A. FERNLEY. I would like also to ask, Mr. President, as to whether the Nasmith is a good machine to use on long staple. We hear about the short staple, what about the long?

Mr. STEPHEN C. LOWE. We have at work in this country over 500 of them on all classes of work. In one mill especially that I have in mind they comb nothing but the longest Sea Island cotton and we have had four orders, being three repeat orders after the first installation.

Mr. JOHN A. FERNLEY. Just one more question. The question is this in my mind, as to how it compares with the Whitin comber?

Mr. STEPHEN C. LOWE. I would rather, Mr. President, not make any comparison. I am not here particularly to exploit the difference between a rival comber and ours. I have merely read this paper at Mr. Nasmith's request. We give you the facts about our comber and we are very glad to have it investigated.

The PRESIDENT. It seems to me that that point is well taken.

The next paper on the program is by Mr. WILLIAM F. PARISH, JR., one of our members well known in this country but at present residing abroad, a recognized expert on the subject of lubrication. He has written several papers for us before and this is his latest production, which will be read by Mr. C. H. PARKER of New York.

ECONOMIC POSSIBILITIES OF GOOD LUBRICATION, WITH THE RESULTS OF TWENTY POWER TESTS.

WILLIAM F. PARISH, JR., Stubenring 2, Vienna, Austria.

The investigations of Dr. THURSTON, which were of the highest value in showing the possibilities of efficient lubrication, and the experiments made by Dr. WOODBURY, which proved the considerable power differences between various lubricants when used on a testing machine, prompted the author, some twelve years ago, to transfer the investigation of this subject from the laboratory to the manufacturing plant itself, where lubricating conditions could be observed on a broader scale under actual running conditions.

There were many obstacles to be overcome, but from what seem now the rather crude methods at first used an elaborate system has been envolved, which at present in the plant itself gives results of approximately laboratory accuracy.

It will be the object of this paper to discuss the subject of lubricating economies in a general way, to show the means employed to demonstrate these economies, and to give the results actually obtained in various mills in different parts of the world.

If it were possible to entirely remove all friction by means of ideal lubrication the life of all power machines and all machines driven by power would be greatly increased; almost no repairs would be necessary and practically all the power generated could be utilized for useful work. The great difference in the mechanical efficiency of machines caused by the differences in quality, or in suitability, of the lubricants used is not generally known, and engineers usually overlook the economic possibilities

contained in this item of the influence of lubrication upon friction, due, no doubt, to the fact that all lubricating oils are considered "necessary evils" without any particular virtue as compared one with another. The greater number of lubricating oil users consider that they have given this problem all the attention it deserves when they buy the lowest priced oils they can get and use them freely. As it is intended in this paper to deal principally with power losses, the waste of such a policy will not be discussed here.

Reduction in frictional losses and consequent saving of power depends upon four conditions:

1. Ability to manufacture various lubricants which will contain a maximum of lubricating nature.

2. The type and condition of the machine or plant to be operated upon.

3. The character and suitability of the lubricant in use and the method of its application.

4. Ability to determine the lubricants which, when placed upon machines of different kinds, will in comparison with those in use produce a lower co-efficient of friction.

While a consideration of the various methods used in manufacturing lubricating oils might be of interest, it is outside the subject of the present paper, but it should be said here that it is possible to make lubricants in such a way that the results of their application are known beforehand, and it is also possible for an engineer trained in this power-saving work to judge within a few per cent. of the exact reduction which it will be possible to secure upon particular machines against any oil in use.

Otherwise it would be impossible to maintain in many countries important engineering departments, fully equipped with expensive instruments for the purpose of showing upon all classes of machinery frictional losses caused by improper lubrication.

WHAT LUBRICATION EFFECTS.

The main effects, which show as a result of reducing the friction of a plant and which must appear in the complete summary of a full comparative power test, are as follows:

1. *a.* Reduction in the total horse power of the mill.
   b. Reduction in the power of transmission, and of the power of each subdivisional part of the mill.
2. Reduction in the amount of coal required for developing the power necessary to drive the mill. (Whether it is possible to show this reduction in coal, however, depends upon the ratio of coal to horse power being maintained during both conditions of lubrication. Many experiments have been made which prove that, in the majority of plants, the amount of coal used is not strictly in accord with the work being done.)
3. Reduction in the amount of feed water used for power purposes. (This item is closely related to the amount of horse power being developed, assuming, of course, that steam is not blown off and wasted.)
4. Reduction in the temperature of all bearings and spindle bases.
5. *a.* Increase in the speed of machines and spindles.
   b. Increase in the speed of line shaft.
   c. Increase in the speed of the engine if the load upon the engine has been excessive. (These increases of speed are due to the fact that reducing the resistance reduces the per cent. of slippage of the driving belts and bands.)
6. *a.* Increase of production of the plant if the production is related to the speed.
   b. Increase in production due to less stoppages,—a considerable per cent. of stoppages are caused through defects of lubrication.
7. *a.* Decrease in repairs.
   b. Decrease in the number of bands required for driving spindles.
   c. Decrease in the wear on the belts which would be perceptible, during a long period of time, in decrease of renewals.

All the foregoing conditions will show to some extent if a reduction in friction has been made. They all depend upon each other to a very considerable degree.

COST OF GOOD VERSUS POOR LUBRICATION.

There is one other point to be discussed, and that is, the cost of obtaining a reduction in friction and the value resulting to the buyer.

From the records of many years' work it is found that the money value of a ten per cent. reduction of the total horse power of a manufacturing plant will more than equal the cost of lubricants for one year. In individual cases it is easy to obtain a record of the total cost of coal for power (coal being the only item effected of which it is convenient and possible to keep a yearly or monthly record), the total horse power, and the cost for oil for one year. It is then possible to determine whether a reduction of a certain amount of power will be of value.

The actual cost for good lubricants need not exceed fifteen per cent. more per year than the cost of the cheapest and poorest. In many cases the cost per year has been reduced by from five to twenty per cent., while the price per gallon of the new oil has been sometimes three times greater.

If the engine were overloaded to such an extent that it need be replaced by a larger one, or a motor installed and current purchased, then any reduction that could be made which would keep the old engine in service should be credited with the entire cost of the proposed installation, interest on the investment and any amount saved by not shutting down the plant for the alteration.

PRACTICAL EFFECTS OF CHANGES IN LUBRICATION.

In countries where reductions in power through lubrication have been accepted at their full value, it is customary for owners to investigate the frictional losses in their plants before making any change in their driving power.

In Germany a manufacturer intended to install a thirty horse power electric motor in order to operate additional machinery which had been purchased, his steam engine having already reached its maximum power. A change was made in lubricants with the result that over fifty horse power was saved, which allowed

the new machinery to be operated by the original engine without the expense of purchasing an additional motor. At the same time the cost of lubrication with the new oils was fifteen per cent. below the yearly cost of the lower priced and poorer lubricants. (Test No. 10.)

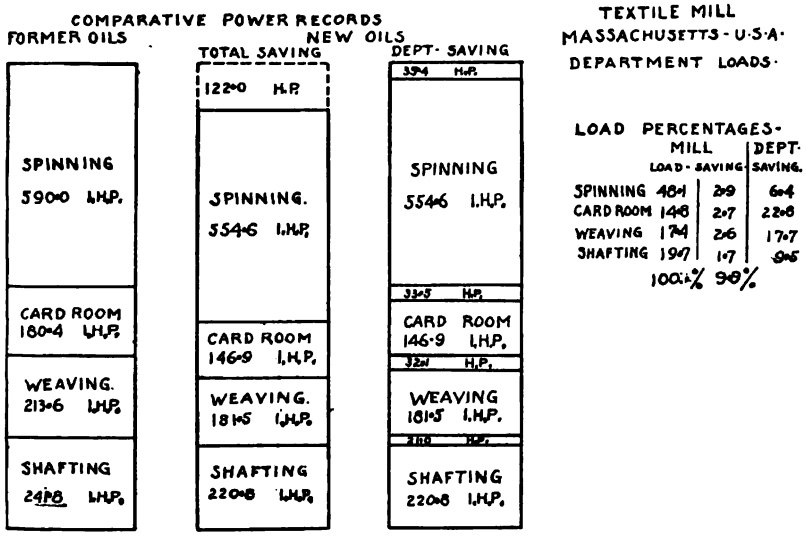


FIGURE 1.
CHART SHOWING SAVING IN POWER BY CHANGING OILS.

In a department in a cotton mill in England it would have been necessary to put in either a larger engine or an electric motor as the load was being greatly increased. By the substitution of better oils the extra load has been put on the original engine, which runs slightly over normal speed, thus showing there is a reserve power which did not previously exist.

In England the steam engine in a joiner's shop was to have been removed on account of its being too small for the work and electrical motors installed to drive the plant. A change in lubricants, which brought about a reduction of over one fifth of the total load, so relieved the engine that it was amply large enough for the work and the extra expense for the motor was not necessary. (Test No. 20.)

In America in a cotton mill driven by water turbines, power was saved by a change of lubricants which allowed the speed of the mill to be increased by two per cent. with the same amount of water. At another water power mill it was found that by changing their lubricants, a 150 horse power engine used as an auxiliary, was not necessary as the wheels were quite sufficient with the reduced total load.

In America there have been numerous cases where the engines have not been large enough to drive the entire plant, especially in the morning when the load was heavy, yet by changing the lubricants and saving a percentage of the frictional loss the load was so reduced that the engines were quite large enough for the work.

In a mill in Finland, motors had been installed to drive certain machines, and upon starting, these motors were found to be too small for the work. Changes were made in the lubrication of the machines to be driven by the motors, which resulted in saving nearly one sixth of the total horse power, when the motors carried the load easily.

In Switzerland in a mill operated by water power, during the season of the year when the water is low and the power of great value, the greatest care is taken to reduce the frictional item of the mill to the lowest point by the use of suitable lubricants. The same care however is not exercised during the period when an excessive quantity of water is to be had.

In Russia, even where the price of the necessary lubricants for securing frictional reductions is from 10 to 20 times more than the cost of local oils, the results from their use is found to justify the extra expense.

In India it has been found possible to operate machines and plants at higher speed, giving a greater production at less cost for power and with absolutely no stoppages from heated bearings, simply by taking advantage of the greater possibilities of friction-reducing lubricants.

The foregoing instances are the practical observations made by the shop and mill managers during the progress and at the

conclusion of tests for lubrication efficiency. The frictional loss reductions were being more carefully recorded by a comparative power test. A full description of the methods used for proving and determining the value of saving friction, with the summary of results obtained in the various countries and upon the various kinds of plants will, it is hoped, largely add to the knowledge on the subject.

DESCRIPTION OF VARIOUS KINDS OF PLANTS OPERATED UPON.

The plants upon which the tests in this paper were made are average plants in the following lines of business:

Cotton Spinning Mills.
Cotton Weaving (and Combined Plants).
Woolen Spinning and Weaving.
Worsted Spinning and Weaving.
Linen Spinning and Weaving.
Jute Spinning and Weaving.
Engineering (Machine) Shops.
Wood Working (Joiner's) Shops.
Electrically Driven Machine Shops.
Flour Mills.
Paper Mills.

The plants are in America, England, Germany, Russia, Japan, and India.

The average mill for each class of textile in all countries consists of about the same proportion of machines of various types. While these are closely related as far as their mechanical operation is concerned, the frictional surfaces depend to a considerable extent upon features introduced by the different manufacturers. Some mills of course will have extra machines for the purpose of simplifying the various operations or for making some specialty. The mills for each class of work in each country present individual characteristics that give additional interest to the comparative results of power tests secured by using the same system of observation.

The plants for spinning the vegetable and animal fibres

are quite different. The machinery in regard to weight, or what would impress the investigator as fineness, would put silk mills first, cotton second, worsted third and woolen fourth. Flax, jute and linen mills contain very much heavier machinery than the other spinning mills and the mills are so very different from cotton and woolen mills that they require quite different treatment in regard to lubrication.

In making comparative efficiency tests it would be reasonable to expect to be able to secure better data from a mill containing light machinery owing to the variables in the power being smaller. The results however seem to show that with care and expertness even the variables do not require to be greatly considered.

SELECTION OF PLANTS FOR TESTS.

A large and well organized staff of salesmen is constantly endeavoring to secure plants where lubricating oils, which are specially manufactured to reduce friction, can be introduced. Whenever a mill director shows an interest in the subject and desires an opinion in regard to the frictional losses in his plants, a specially trained inspecting engineer makes a careful report upon all the frictional characteristics of the plant. The chief testing expert then compares this information with the records of plants already tested upon, tempering his opinion with his own knowledge of local influences and conditions, and an estimate of a certain percentage of reduction in the total power is given the management. The matter is then decided upon the basis of whether the reduction in power would be of sufficient value to the mill to make the proposed tests.

PLAN AND SCOPE OF TESTS.

The purpose of the tests is to prove that a reduction in power is secured by placing more suitable oils in use, and it is therefore necessary to secure an absolute average horse power of the plant under ordinary working conditions with the old oil and to have the records so complete that a duplicate power test can be made at some future time under absolutely the same conditions.

In each test given in this paper the value of the change has been secured through the actual lubricating virtues of the oil which has been used to secure the reduction in friction. The power reductions are not in any way due to changes made in the mechanical running of the shops and mills operated upon, such as cleaning of bearings and relining of shafts. Work of this character is never allowed to take place during the period between the two tests which are required for the comparative results. The utmost care is exercised so that the results will show nothing except the absolute difference between the lubricating character of the oils which were found in use and the oils which are substituted.

When testing under this system was begun one of the first problems to be solved was how to nullify, offset, or record the influence upon the total power of the plant tested upon by the stopping and starting of the various machines. Assuming that a total reduction in horse power of five per cent. was secured through a change in lubricants it was necessary to determine that this reduction was not due to any other feature, and it was also important that some ouside influence did not entirely absorb this reduction. The solving of this problem has made it necessary to establish a rather elaborate system of indicator work and to have the schedules of such tests arranged so that the best average load can be secured.

To make a proper comparative power test each plant must be taken individually and consideration given to the effects of weather and the class of work the plant is engaged upon. The possibilities must also be considered of the same conditions existing at some future time when all changes in lubrication which are to take place have arrived at a good basis. This requires a knowledge of the effect of temperature, humidity, and the change in the material which the plant manufactures, as well as a general knowledge of all the conditions surrounding the particular class of plant operated upon.

The work load factors in the various tests are determined by means of frequent reports made by the overseers of each depart-

FIGURE 2.—TESTS IN A SPINNING MILL, WARRINGTON, ENGLAND.

FIGURE 3.—TESTS IN A SPINNING MILL, HYDE, ENGLAND.

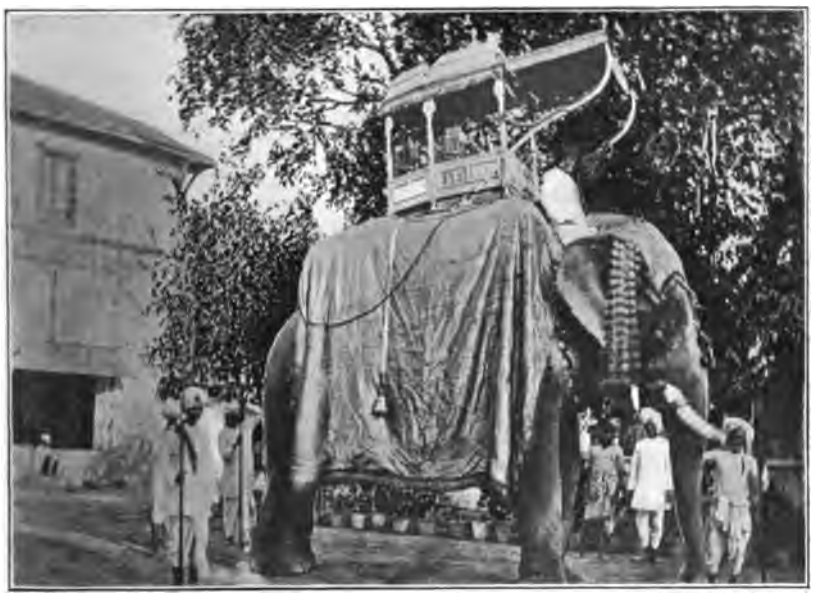


FIGURE 4.—TRANSPORTING TESTING INSTRUMENTS IN INDIA.

FIGURE 5—TRANSPORTING TESTING INSTRUMENTS IN IRELAND.

ment. These reports show the number and kind of machines that are not in operation for periods exceeding fifteen minutes. The horse power for all machines requiring correction is ascertained and a debit and credit balance is made so that both tests will be upon a comparative basis.

The engineering shop tests which are given in this paper, with one exception, have been run from electric motors and therefore are necessarily only sections of larger shops. The one exception is a plant which is operated by a Willan's high-speed engine. The comparative tests on engineering shops are made by having all the machines run at their regular speed but without any work in the lathes or on the cutting tables. In this way the work factor is entirely eliminated and comparative conditions can be duplicated.

All the plants operated upon were working under ordinary conditions, and they continued to work in the same condition as long as the test was being made.

DETAILS OF ACTUAL TESTS.

The straight test for one condition usually requires three days. About forty sets of indicator diagrams are taken each day while the engine is carrying full load, a set being all the cards taken from all indicators in operation at one time. A day's record is also made of the horse power required to operate the engine and transmission. This load is usually taken at noon, and not less than ten sets of diagrams are taken for each test. Where a subdivisional test showing the load of each department is being made, the schedule is so arranged that different departments are thrown out of operation for periods not exceeding one half hour, during which time never less than ten sets of diagrams are taken to secure the average load for the balance of the machinery. On a simple test, with four indicators, a full load and transmission test requires 200 diagrams per day. When eight indicators are used in a subdivisional test, the number of diagrams per day sometimes reaches 2,000, which would make 8,000 indicator diagams for a four day comparative test. Never has their

been a business that has allowed men to become so expert in indicator work as that which requires the conducting of these tests for showing the comparative efficiency of lubricating oils, and the tests given in the present paper, which are only a small selection from those that have been made, could not have been conducted unless there has been an equal opportunity to organize a highly trained staff of engineers native to each country and to equip these men with every instrument necessary for their work.

METHOD OF CONDUCTING A TEST.

It has been found from experience that Monday is a very unsatisfactory day for securing the power of the textile mills and of any other plant that has been shut down over Sunday. This day, therefore, is usually given to setting up instruments and laying out the test. Schedules are prepared and the different men individual to each plant are instructed in regard to their various duties. The test starts Tuesday morning and is usually of eight hour's duration, schedules being arranged to secure an average load which will be quite away from the influences of the breakfast hour in England, the rest hours on the Continent, and noon hours in America, each country having some peculiarity which interferes with a uniform schedule. Mills in Japan run day and night for the entire week which makes it impossible to secure transmission and subdivisional data.

The diagrams are all taken at regular intervals prescribed by the schedule and as fast as they are taken they are stamped and worked out by the Planimeter engineer. The mean effective pressures are then written upon log sheets and at the conclusion of the day's test, the constant of each end of each cylinder having been obtained, the horse power for each card is worked out either with a twenty inch slide rule or a multyplying machine and the result put on the log sheets. These log sheets are so arranged that by totalling the horse power vertically and horizontally the result will be self-checking. The tests are repeated for two or three days in order that a fair average of all surrounding condi-

tions may be secured. Each separate section of the test has a letter assigned to it, such as A., B., C., etc. Reference to the schedule shows at what time and under what conditions this particular test was made. The comparative test which is made under the same conditions at a later period has the determining letter doubled as AA., BB., CC. Each indicator card is stamped with the date, time, the name of the firm, and this determining letter; all other information in regard to general surrounding conditions, springs, and instrument numbers being kept in a record book, or upon the face of the envelope in which each particular group of cards for any one test is put. For each test the records of all the power influences are made by engineers expert in one particular class of observation. The tabulating and figuring is done mechanically as far as is possible in order to eliminate the personal factor.

DESCRIPTION OF INSTRUMENTS FOR MAKING THE TESTS INDICATORS.

The instruments used in making these tests are as follows:

Crosby (Boston) Inside Spring Indicators. For all high and low pressure cylinder work in America, and for low pressure cylinder work in England, Japan, and India.

Crosby Outside Spring Indicators. For all high pressure work in England and Japan.

Maihak (Hamburg) Indicators, having outside springs, for high and low pressure work in Germany, India, Norway, and Russia.

Each indicating staff has an outfit of eight indicators. The Crosby indicators are fitted with Sargent's electro-magnet attachments, and the Maihak instruments with Maihak electro-magnets.

Current is furnished for the electro-magnets by dry cells and accumulators in America, and by accumulators for all the others, except the Indian and one German outfit, which have small dynamos.

On every test where it is necessary to use two or more indi-

cators the electrical fittings are used, thus enabling indicator diagrams to be taken from all the indicators in service at one time from a central control. This system was not advocated by the committee of the American Society of Mechanical Engineers on engine and boiler tests (Vol. XXIV); but the practice which is necessary in order to conduct the tests given in this paper makes it requisite that such a system be used, otherwise the amount of work and the number of men necessary for each job would greatly increase the cost without improving the efficiency of the test or the accuracy of the results. It is the practice of the engineers making these tests to depend absolutely upon the electrical attachments for the indicators. The great value to be secured from these attachments will not be otherwise discussed at this time.

REDUCING MOTIONS.

With most of the outfits, Crosby reducing wheels are used, four to an eight indicator outfit. Phantographs are also sometimes used with the American outfits, while the Continental engineers work with, and sometimes prefer, the flat spring reducing wheels.

In England, Japan and India about fifty per cent. of the engines tested have their own reducing motions. Of these about twenty per cent. must be in some way adjusted or have quadrants fitted before they can be considered accurate, while twenty per cent. can be considered accurate enough without addition, but usually with adjustments. The rest have a gear that is absolutely wrong.

In America the percentage of fixed reducing motions is about forty per cent., and possibly one-half require to be fitted with quadrants, while occasionally an engine is found having reducing fittings which are constantly in motion irrespective of whether indicator diagrams are taken or not. It has been found that these fittings are worn, so that they are not accurate enough for careful tests. A reducing motion should never be permanently allowed to run; it should be considered in the same light as the indicator, and should receive the same attention.

In Germany about ten per cent. of the engines have reducing motions which can be attached, these fittings being furnished with the engines. The usual custom is to fit dangerously long bars into the cross-heads and drive directly from a flat spring reduction roll.

MEASURING INSTRUMENTS.

Amsler No. 6 Planimeter (Switzerland) used as a standard in every outfit, three planimeters to eight indicators. This planimeter reads directly the mean effective pressure of the card if the diagram is made with a forty pound spring. Working with engine and spring on the metric system the planimeter requires a constant.

Tachometers for spindle and shaft speeds are all made by Dr. Horn of Leipzig (Germany).

Tachoscope, an instrument which is a combination of a speed counter and a stop watch, is made by M. Guggenheim, Bale (Switzerland).

Pyrometers, *Thermometers*, *Hygrophants*, *Hygrometers*, *Hygrodikes*, etc., by Taylor Bros., Rochester, N. Y.; Hohmann and Maurer, London; Casartelli, Manchester, (England); and Dr. Siebert and Kuhn, Cassel, (Germany).

Attached to most of the outfits are *adding machines* such as the Brunsviga (German) or Burroughs (American) and each department has also from one to five dynamometers of the Emerson pattern for use in securing the power of small machines.

CALIBRATION OF INSTRUMENTS.

All instruments are calibrated and standardised after the best known methods. The element of standardising, however, is not a particular important one as these tests are comparative. The instruments are all marked in such a way and the records are kept, so that the same instruments can be used in the same place for the same sets of observation for the comparative test. Any slight variation which may occur in one instrument, therefore, will not show in the comparative result. Notwithstanding this

fact indicators and speed instruments as well as thermometers, are constantly standardised in order that the results from all the tests may be comparative and of value.

THE TEST REPORTS IN THIS PAPER.

Tables are annexed to each summary of test, showing the maximum and minimum horse power reading of each day's test, the variation in percentage from the average load of the day, and the percentage of variation of each of the two or three days' averages. From a study of these variations it will be seen that the variables, caused by the machines going on and off and by the working of the engine governor in attempting to equalize the speed, average to a very fine degree. It will also be obvious that investigations such as are being described would be quite worthless if made upon any other basis of indicator work, as the variables would either entirely offset the reductions, or act in the opposite way, and would give information very untrustworthy for the following tests. The speeds taken during each test are quite complete, and at least ten readings of the speed of any one item are taken in order to form the average. The speed of the engine is secured by means of a continuous counter, the number of revolutions being recorded every ten or fifteen minutes.

Temperatures and relative humidity are secured at intervals of from one-half to one hour, and are taken during the day, or day and night, as the conditions seem to require.

Permission to publish the names of mills where tests have been made has, in some instances been withheld, so that all tests will be designated only by number and name of state, or city, and country.

SUMMARY OF TESTS.

No. of Test.	Country.	Plant.	MILL OILS. I Test. Full Load I. H. P.	MILL OILS. I Test. Trans-mission. I. H. P.	NEW OILS. II Test. Full Load. I. H. P.	NEW OILS. II Test. Trans-mission. I. H. P.	Per cent. of Trans-mission to Full Load. I Test.	Per cent. of Trans-mission to Full Load. II Test.	Power Reductions. Full Load. Per cent.	Power Reductions. Trans-mission Per cent.
1	America	Cotton	543.21	192.70	481.75	168.90	35.4	35.0	11.31	12.35
2 A	America	Worsted	611.60	. . . .	596.30	. . . .	. . . .	. . . .	2.50	. . . .
B	America	Worsted	702.90	. . . .	648.70	. . . .	. . . .	. . . .	7.80	. . . .
3	America	Cotton	786.00	. . . .	758.00	. . . .	. . . .	. . . .	3.56	. . . .
4 A	England	Cotton	1,408.60	356.00	1,301.80	319.30	25.3	24.5	7.60	10.30
B	England	Cotton	1,428.40	357.90	1,358.70	348.90	25.0	25.7	4.90	2.50*
5	England	Worsted	348.10	111.10	327.50	99.50	31.9	30.4	5.90	10.40
6	England	Weaving	495.00	146.60	453.60	127.50	29.6	28.1	8.40	13.00
7	Ireland	Linen	110.70	49.90	93.10	38.60	45.0	41.4	15.90	22.70
8 A	Scotland	Woolen	177.70	61.80	164.60	56.10	34.7	34.0	7.40	9.20
B	Scotland	Woolen	325.10	161.40	293.50	147.30	49.6	50.2	9.70	8.70**
9	Germany	Cotton	263.41	114.03	239.35	97.11	43.2	40.5	9.10	14.80
10 A	Germany	Worsted	341.36	118.24	290.53	95.67	31.7	32.9	14.90	19.10
B	Germany	Worsted	341.36	141.29	299.30	119.28	41.3	39.8	12.30	15.57***
11	Germany	Jute	1,135.20	362.60	1,034.20	328.10	31.9	31.7	8.89	9.51
12	Russia	Cotton	1,238.80	. . . .	1,069.10	. . . .	. . . .	. . . .	13.70	. . . .
13	India	Cotton	642.60	230.70	596.80	202.20	35.9	33.9	7.10	12.40
14	Japan	Cotton	346.60	. . . .	313.60	. . . .	. . . .	. . . .	9.50	. . .
15	India	Flour	364.70	. . . .	336.80	. . . .	. . . .	. . . .	7.70	. . . .
16	England	Paper	465.40	. . . .	390.40	. . . .	. . . .	. . . .	16.20	. . . .
17	Germany	Paper	511.37	. . . .	482.43	. . . .	. . . .	. . . .	5.60	. . . .
18	England	Brass shop	6.74x	1.77x	5.12x	1.53x	26.2	29.8	24.00	13.80
19	England	Iron shop	137.80	74.90	116.00	68.10	54.3	58.7	15.80	9.10
20	England	Wood "	84.00	31.60	65.30	25.40	37.6	38.8	22.30	19.60

* Same oil after nine months' use. ** Not full load of Mill. *** Morning load.

x Electrical units.

Test No. 1. Test Made in Massachusetts, U. S. A.

COTTON SPINNING MILL TEST.

Engine — Geo. H. Corliss Cross Compound Engine, 24″ and 48″ x 48″ stroke. The mill is run by two engines. The test was made upon the mill run by No. 1 Engine.

Machinery Operated — All Preparatory Machines. Spinning, both ring and self-actor (mule) and looms. The looms, however, were lubricated with the same material for both tests. Subdivisional tests were made to secure the power of the looms, so it could be deducted from the total power of each test in order that the per cent. of frictional influence might be upon the basis of the total load effected by the change in lubrication.

Complete Test — 6 Days. 4 indicators. 1,400 indicator cards. 3 operators.

Mill Oils. **First Test.— Full Mill Load.**

1902.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, November 18, . .	814.1	703.3	160	781.7	110.8	14.2
Wednesday, November 19, . .	804.4	763.1	160	777.9	41.3	15.3
Thursday, November 20, . .	822.0	723.2	160	773.5	98.8	12.8
				777.70		

Difference of Averages 8.2 H.P. or 1.5 per cent. on Average of Test.

New Oils. **Second Test.**

1903.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, April 21, ...	748.0	683.1	160	720.7	64.9	9 0
Wednesday, April 22, ...	740.4	660.2	160	704.5	80.2	11.4
Thursday, April 23, ...	732.6	686.3	160	713.6	46.3	6.5
				712.9		

Difference of Averages 16.2 H.P. or 2.3 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS.— Average of November 18, 19, 20, 1902, (add 19.51 H.P. for machines, deduct 254.0 H.P. for looms)	543.21
NEW OILS.— Average of April 21, 22, 23, 1903, (add 22.85 H.P. for machines, deduct 254.0 H.P. for looms)	481.75
Reduction, ... or 11.31 per cent.	61.46

Mill Oils. **Engine and Transmission.**

1902.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, Nov. 18, noon . .	201.4	183.9	40	191.1	17.5	9.2
night . .	206.7	177.0	40	197.8	29.7	15.0
Wednesday, Nov. 19, noon . .	215.0	176.5	40	185.9	38.5	20.7
night . .	++					
Thursday, Nov. 20, noon . .	203.9	181.3	40	193.6	22.6	11.7
night . .	209.1	180.2	40	194.7	28.9	14.7
				192.7		

++ Electric light load taken here.

Difference of Averages 11.9 H.P. or 6.2 per cent. on Average of Test.

New Oils.

1903.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, April 21, noon . .	182.6	141.7	40	165.3	40.9	24.7
night . .	191.6	143.3	40	170.0	48.3	28.4
Wednesday, April 22, noon . .	199.1	146.5	40	172.2	52.6	30.5
night . .	190.3	156.2	40	176.8	34.1	19.3
Thursday, April 23, noon . .	187.1	138.2	40	161.1	48.9	30.4
night . .	177.5	150.1	40	167.4	27.4	16.4
				168.9		

Difference of Averages 15.7 H.P. or 9.3 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS.—Average of November 18, 19, 20, 1902, (five tests)	192.7
NEW OILS.—Average of April 21, 22, 23, 1903, (six tests)	168.9
Reduction, ...	23.8

or 12.35 per cent.

Speeds.

Engine and Transmission.

	Engine. A. M.	Engine. P. M.	Engine. Average.	1st Floor Main Drive.	1st Floor Front Drive.	3rd Floor Main Drive.	Shear Room.	Line Shaft Average.
Mill Oils, . . .	84.86	86.42	85.64	341.0	330.1	337.1	337.7	336.47
New Oils, . . .	85.25	85.28	85.27	345.0	328.7	340.5	342.0	338.05

Spinning Frames.

Speeds secured from 20 Frames. (All frames marked for comparison.)

	Engine.	Frame. (Cylinder or Drum)	Spindle.	Per cent. Slippage.
Mill Oils, . . .	85.50	1103.0	9071.0	13.5
New Oils, . . .	85.27	1110.0	9646.0	7.5

Speed of the engine was opposed to the general increase in the speed of the entire mill.

The mill shows an increase in speed of over 1 per cent.

The efficiency of the spinning frames has been very greatly increased.

The production of the frames is regulated by the speed of the tin cylinder or drum. The increase of 7 R. P. M. (.63 per cent.) was utilized by changing the speed of the top rolls to feed more cotton roving to the spindles, which by their higher speed were on the above basis putting more twist into the thread than wanted.

Temperature and Relative Humidity.

Hourly Readings.

	Temperature, Degrees Fahr.			Per Cent. Relative Humidity.		
Days of Test.—	First,	Second,	Third.	First,	Second,	Third.
Mill Oils, ...	88.2	79.9	81.4	44.0	56.5	51.6
New Oils, ...	84.6	87.0	85.9	44.6	41.0	47.2

Average Temperature and Relative Humidity.

	Temperature, Degrees Fahr.	Relative Humidity Per cent.
Mill Oils, Nov. 18, 19, 20, 1902, . .	83.1	50.7
New Oils, April 21, 22, 23, 1902, . .	85.8	44.2

Temperature in favor of a Reduction in Power.

Relative Humidity in favor of a Reduction in Power during the last two days.

Test No. 2. Test made in Rhode Island, U. S. A.

POWER TEST IN A WORSTED MILL IN AMERICA.

Engine — Geo. H. Corliss Cross Compound Engine. Cylinders 20″ and 40″ x 6′ stroke. Steam Pressure 110 lbs. 63 R. P. M. Developing about 600 H.P.

Newburg Cross Compound Engine. Cylinders 22″ and 44″ x 4′ stroke. Steam Pressure 110 lbs. 80 R. P. M. Developing about 700 H.P.

Machinery Operated — Spinning, doubling, (twisting) and all preparatory and finishing machinery.

Complete Test — 6 days. 8 indicators. 1,576 indicator cards. 3 operators.

First Test.— Full Mill Load.

Mill Oils. **No. 1 Engine.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday January 23, . . .	638.6	559.2	128	601.1	79.4	13.2
Wednesday, January 24, . . .	648.7	578.3	136	612.3	70.4	11.5
Thursday, January 25, . . .	636.2	591.5	140	612.3	44.7	7.3
				608.6		

Difference of Averages 11.2 H.P. or 1.8 per cent. on Average of Test.

Mill Oils. **No. 2 Engine.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 23, . . .	709.4	642.8	128	686.2	66.6	9.7
Wednesday, January 24, . . .	753.8	656.1	140	702.5	97.7	13.9
Thursday, January 25, . . .	747.4	686.6	140	720.1	60.8	8.4
				702.9		

Difference of Averages 34.0 H. P. or 4.8 per cent. on Average of Test.

Second Test.

New Oils. **No. 1 Engine.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, May 22, ...	625.5	574.0	116	605.3	51.5	8.5
Wednesday, May 23, ...	616.7	546.5	120	584.9	70.2	12.0
Thursday, May 24, ...	618.4	541.1	144	578.2	77.3	13.4
				589.5		

Difference of Averages 27.1 H.P. or 4.6 per cent. on Average of Test.

New Oils. **No. 2 Engine.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, May 22, ...	713.2	662.4	120	655.6	90.8	10.8
Wednesday, May 23, ...	669.3	619.9	120	643.1	49.4	7.7
Thursday, May 24, ...	673.4	624.0	144	647.3	49.4	7.6
				648.7		

Difference of Averages 12.5 H.P. or 1.9 per cent. on Average of Test.

Owing to the great difficulty of getting the two engines to run at a uniform speed on a mill load no test could be made upon the Engine and Transmission Load.

Results of Power Test.

No. 1 Engine.

	I.H.P.
MILL OILS.—Average January 23, 24, 25, 1906, 608.6, (add 3.0 H.P. Machinery Correction)	611.6
NEW OILS.—Average May 22, 23, 24, 1906, 589.5, (add 6.8 H.P. Machinery Correction)	596.3
Reduction, ...	15.3

or 2.5 per cent.

No. 2 Engine.

	I.H.P.
MILL OILS.—Average January 23, 24, 25, 1906	702.9
NEW OILS.—Average May 22, 23, 24, 1906	648.7
Reduction, ...	54.2

or 7.8 per cent.

Speeds.

No. 1 Mill and No. 1 Engine.

(Speeds given are average for the day.)

	MILL OILS.				NEW OILS.			
	Jan. 23.	Jan. 24.	Jan. 25.	Average.	May 22.	May 23.	May 24.	Average.
Engine . .	64.71	65.33	64.66	64.90	64.75	65.45	64.99	65.01
1st Floor.								
Shaft 2 . .	219.0	224.5	219.0	219.2	221.0	220.0	220.5	220.5
" 3 . .	219.0	219.0	219.5	219.0	220.2	219.7	219.2	219.8
" 4 . .	219.0	219.5	219.5	219.4	219.0	218.5	221.0	219.5
" 5 . .	221.5	220.5	220.0	220.5	221.0	221.7	222.2	221.7
" 6 . .	222.5	222.2	221.0	221.8	221.0	221.1	223.0	222.0
2nd Floor.								
Shaft 7 . .	. .	220.0	219.0	219.5	219.7	219.0	218.2	219.0
" 8 . .	218.0	217.2	216.5	217.1	219.0	218.5	218.2	218.6
3rd Floor.								
Shaft 9 . .	218.5	218.0	216.7	217.6	218.5	218.7	218.7	218.7
Average Speed of all Shafts,				219.24				219.97

	Engine R. P. M.	Shaft Speed R. P. M.	Rev. of Shafting to one of Engine.
Mill Oils,— Average January 23, 24, 25, ...	64.90	219.24	3.37
New Oils,— Average May 22, 23, 24, ...	65.01	219.97	3.38
Increase, ...			.01

or 0.3 per cent.

No. 2. Mill and No. 2 Engine.

	MILL OILS.				NEW OILS.			
	Jan. 23.	Jan. 24.	Jan. 25.	Average.	May 22.	May 23.	May 24.	Average.
Engine . .	79.59	79.58	79.39	79.52	79.75	80.38	79.75	79.96
1st Floor.								
Shaft B . .	223.0	223.2	221.0	222.8	221.7	223.7	223.0	222.8
" C . .	221.0	222.2	218.7	220.6	221.7	224.0	223.2	223.0
2nd Floor.								
Shaft D . .	223.0	224.0	222.5	223.2	221.7	222.5	222.7	222.3
" E . .	222.5	223.0	223.2	223.0	223.5	223.5	224.5	223.8
3rd Floor.								
Shaft F . .	221.5	222.0	221.7	221.8	222.2	224.0	223.2	223.2
" G . .	223.5	223.0	223.0	222.9	223.0	225.2	224.2	224.2

	Engine R. P. M.	Shaft Speed R. P. M.	Rev. of Shafting to one of Engine.
Mill Oils.— Average January 23, 24, 25, ...	79.52	222.37	2.79
New Oils.— Average May 22, 23, 24, ...	79.96	223.22	2.79
Increase, ...			.00

Summary.

Reduction on the total load of the mill due to better lubrication:

Engine 1, ... 15.3 H.P. or 2.5 per cent.
Engine 2, ... 54.2 H.P. or 7.8 per cent.
Engine Speed increases (Engine 1), ...11 R. P. M. or .02 per cent.
Engine Speed increases (Engine 2), ...44 R. P. M. or .06 per cent.

Shaft Speed of Mill and Engine No. 1 increases 0.3 per cent. while there was no increase on Shaft Speed of Mill and Engine No. 2.

Test No. 3. Tests Made in Massachusetts, U. S. A.

A Speed and Power Test Upon a Cotton Mill Run by Water Wheels.

A complete record of speeds was taken for each of the three days of each test, combined with careful observations of the Gate Opening. Wheel Speed, Water in the Wheel Pit, Head, from which was estimated the cubic feet per second, the Mill Power and the Horse Power according to well established rules.

Average of Water Wheel Data.

Observations Made.	Mill Oils, January 5, 6, 7, 1904.	New Oils, May 10, 11, 12, 1904.	Efficiency.	
				P. Ct.
Gate on Wheels (Degrees), ...	691°.	629°	— 62°	8.97
Wheel Speed (R. P. M.), ...	129.20	132.10	+ 2.90	2.20
Penstock Gage, ...	99.83	99.98	+ .15	.15
Wheel Pits, ...	80.28	79.85	— .43	.53
Head, ...	19.40	20.12	+ .72	3.70
Water (cubic feet per second), . .	436.10	413.80	— 22.30	5.10
Mill Power, ...	11.22	10.91	— .31	2.76
Horse Power, ...	786.00	758.00	28.00	3.56

Average of Speed Data.

Observations Made.	Mill Oils, January 5, 6, 7, 1904.	New Oils, May 10, 11, 12, 1904.	Increase Speed.	
	R. P. M.	R. P. M.	R. P. M.	P. Ct.
Water Wheels, ...	129.2	132.1	+ 2.9	2.24
Jack Shaft, ...	209.4	214.3	5.9	2.81
Basement Drive, ...	259.6	266.0	6.4	2.47
1st Floor Drive, ...	260.4	267.2	6.8	2.61
2nd Floor Drive, ...	275.2	281.8	6.6	2.40
3rd Floor Drive, ...	335.6	342.0	6.4	1.90
3rd Floor Counter, ...	325.0	331.8	6.8	2.09
3rd Floor Motor, (not in summary)	587.4	590.8	3.4	.57
Motor Driven Shaft, ...	328.8	332.8	4.0	1.21
Top Floor Drive, ...	330.2	338.9	8.7	2.63
11 Frames (numbered), ...	1,108.0	1,148.0	40.0	3.61
Spindles on above Frames, ...	8,998.0	9,213.4	215.0	2.38

Summary.

The result of this test is that the reduced friction caused by the use of the New Oils allowed the mill to operate at	8.97 per cent.
less gate opening on wheels; owing to this less opening and less water required, the water in the Wheel Pit was .	.53 "
less. The Penstock Gage shows	.15 "
higher during the last test	
Amount of water used was reduced	5.1 "
Mill Power — which is figured on the basis of cubic feet of water per second is reduced	2.76 "
The Horse Power (figured by the speed and opening of gate and head and Penstock openings) is reduced	3.56 "
Yet with the reduced amount of water used the speed of the different sections of the mill increased from . . .	1.21 to 2.81 "
The Frame speed increased	3.61 "
The Spindle speed increased	2.38 "
This proposition reduces itself to this:—	
By using the New Oils the Mill is able to produce from 2 to 3 per cent. more material with	5.1 "
less water	

Test No. 4. Test Made at Warrington, England.

COTTON SPINNING MILL TEST.

Engines — Two Tandem Compound side by side (Double Tandem Corliss Compound), 46.5 R. P. M. Steam Pressure 120 lbs. superheated to 420 degrees Fahr. at stop valve. Developing over 1,400 I. H. P.

Machinery Operated — Ring and Self-actor (mules), Spinning and all preparatory machines.

Complete Test — 8 days. 8 indicators. 2,848 indicator cards. 7 operators.

This test covered a period of two years, so a brief summary of the machine corrections will be given in order to show how the test was worked to a comparative basis. The Mill Management wished to see the result of the application of the New Oil upon each separate class of machinery which made this very extensive but exceedingly interesting test necessary. The full report covers 46 pages.

Mill Oils. **First Test.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 26, . . .	1,402.8	1,305.7	320	1,351.2	97.1	7.1
Wednesday, January 27, . . .	1,391.6	1,260.0	320	1,348.3	131.6	9.8
				1,349.8		

Difference of Averages 2.9 H.P. or 0.2 per cent. on Average of Test.

New Oils. **Second Test.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, September 6, . .	1,347.9	1,235.2	320	1,294.9	112.7	8.7
Wednesday, September 7, . .	1,363.3	1,275.4	320	1,308.8	87.9	6.7
				1,301.8		

Difference of Averages 13.9 H.P. or 1 per cent. on Average of Test.

Mill Oils. **Engine and Transmission.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 26, . . .	442.1	310.7	80	357.8	131.4	36.7
Wednesday, January 27, . . .	488.3	302.2	80	354.1	186.1	52.5
				356.0		

Difference of Averages 3.7 H.P. or 1 per cent. on Average of Test.

New Oils.

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, September 6, . .	321.8	305.5	80	310.0	16.3	5.3
Wednesday, September 7, . .	345.3	305.5	80	328.6	39.8	12.1
				319.3		

Difference of Averages 18.6 H.P. or 5.8 per cent. on Average of Test.

Ring Spinning, Engines and Shafting Load.

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Mill Oils, Tuesday, January 26, . . .	832.1	745.0	80	810.1	87.1	10.7
New Oils, Wednesday, September 7, . .	794.9	772.5	80	786.1	22.4	2.8

Result.

Full Mill Load.

	I.H.P.
MILL OILS. — Average of January 26, 27, 1904 (Correction for increased speed of spindles 58.8 H.P)	1,408.6
NEW OILS. — Average of September 6, 7, 1904, ...	1,301.8
Reduction, ...	106.8

or 7.6 per cent.

Engine and Transmission.

MILL OILS. — Average of January 26, 27, 1904,	356.0
NEW OILS. — Average of September 6, 7, 1904,	319.3
Reduction,	36.7

or 10.3 per cent.

Ring Spinning, Engines and Shafting.

	I.H.P.
MILL OILS. — January 26, 1904 (Correction for increased speed of spindles)	868.8
NEW OILS. — September 6, 1904,	786.1
Reduction,	82.7

or 9.5 per cent.

Ring Spinning Only (by deduction).

	I.H.P.
MILL OILS. — January 26, 1904,	512.8
NEW OILS. — September 6, 1904,	466.8
Reduction,	46.0

or 8.9 per cent.

Work.

Counts spun. The Mill consider the class of work done to be slightly in favor of a reduction in Power.

Temperature and Relative Humidity.

Average Readings from Four Spinning Rooms.

	Temperature, Degrees Fahr.	Relative Humidity. Per Cent.
Mill Oils, Jan. 26, 27, 1904,	80.8	59.4
New Oils, Sept. 6, 7, 1904,	83.5	60.6

Temperature slightly in favor of a Reduction in Power.
Relative Humidity against a Reduction in Power.

Average Temperature.

Frame No. 17 (speeded up between tests.)

1904.	Spindles R. P. M.	Temperature of Room, Degree Fahr.	Temperature of Spindle rail Degree Fahr.	Difference due to Friction Degree Fahr.
Mill Oils, January 26, 27,	8,688	79.8	93.5	13.7
New Oils, September 6, 7,	9,800	86.4	96.4	10.0

Reduction, Frictional Temperature, ... 3.7 degrees Fahr.
or 27.0 per cent.

Frame No. 18 (same speed of drive).

1904.	Spindles R. P. M.	Temperature of Room, Degree Fahr.	Temperature of Spindle rail Degree Fahr.	Difference due to Friction Degree Fahr,
Mill Oils, January 26, 27,	8,325	79.7	95.1	15.4
New Oils, September 6, 7,	8,616	86.4	96.6	10.2

Reduction, Frictional Temperature, ... 5.2 degrees Fahr.
or 33.8 per cent.

The speed of the spindles show an increase of 291 R. P. M.

Speeds During Test.
(Including No. 18 Frame).

1904.	Engine.	Line Shaft.	Spindle.
Mill Oils, January 26, 27,	46.63	128.9	8,325
New Oils, September 6, 7,	46.53	126.2	8,616

Proportion of Engine to Spindle Speed.

	R.P.M.
MILL OILS.—Revolutions of Spindle to 1 R. P. M. of Engine, ...	1.78
NEW OILS. — Revolutions of Spindle to 1 R. P. M. of Engine, ...	1.85
Increase, ...	.07

or 0.4 per cent.

Second Series of Tests.

(Test No. 3 of Complete Series).

New Oils (with one old oil.)

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, April 5, ...	1,480.8	1,408.6	192	1,440.1	72.2	5.0
Thursday, April 6, ...	1,460.5	1,369.5	192	1,416.8	91.0	6.4
				1,428.4		

Difference of Averages 23.3 H.P. or 1.6 per cent on Average of Test.

All New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, January 17, . . .	1,391.9	1,341.8	192	1,363.3	50.1	3.7
Thursday, January 18, . . .	1,393.4	1,326.4	192	1,354.1	67.0	4.9
				1,358.7		

Difference of Averages 9.2 H.P. or 0.7 per cent. on Average of Test.

New Oils. **Engine and Transmission Test.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of test.
Wednesday, April 5, ...	392.8	291.3	80	340.0	101.5	29.8
Thursday, April 6, ...	440.2	344.7	80	375.7	95.5	25.4
				357.9		

Difference of Averages 35.7 H.P. or 10.0 per cent. on Average of Test.

All New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of test.
Wednesday, January 17, . . .	369.5	319.4	80	340.6	50.1	14.7
Thursday, January 18, . . .	435.3	305.3	80	357.3	130.0	36.4
				348.9		

Difference of Averages 16.7 H.P. or 4.8 per cent. on Average of Test.

Work.

Counts spun. The Mill directors consider there will be no difference in power owing to this item.

Temperature and Relative Humidity.

Average Readings From Four Spinning Rooms.

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
Mill Oils, Average of April 5, 6, 1905, ...	79.8	34.8
New Oils, Average of January 17, 18, 1906, . . .	81.6	38.5

Temperature slightly in favor of a Reduction in Power.
Relative Humidity slightly against a Reduction in Power.

Result.

Full Mill Load.

	I. H. P.
NEW OILS and one Mill Oil. — Average of April 5, 6, 1905, ...	1,428.4
ALL NEW OILS. — Average of January 17, 18, 1906, ...	1,358.7
Reduction, ...	69.7

or 4.9 per cent.

Engine and Transmission.

NEW OILS. — Average of April 5, 6, 1905, ...	357.9
NEW OILS. — Average of January 17, 18, 1906, ...	348.9
Reduction, ...	9.0

or 2.5 per cent. (Representing the improvement after nine months use of the New Oils).

Summary.

Results of Complete Series of Tests.

Reduction on Engine and Transmission, ...	36.7 H.P. or 10.3	per cent.
Reduction on Ring Spinning only, ...	46.0 H.P. or 8.9	"
Reduction on Preparatory Machinery and Mules . .	61.8 H.P. or 10.7	"
Total Reduction on Full Load, ...	144.5 H.P. or 10.6	"

Temperatures.

Reduction on Frame speeded up, ...	3.7 degrees Fahr. or 27.0	per cent.
Reduction on Frame same speed, ...	5.2 degrees Fahr. or 33.8	"

Test No. 5. Test made at Leicester, England.

POWER TEST ON A WORSTED MILL.

Engine — Pollitt and Wigzell, Sowerby Bridge, 1895. — Horizontal Tandem Compound, 17″ and 32″ x 4′ stroke. Steam Pressure 100 lbs. 76 R. P. M. Developing about 350 I. H. P.

Machinery Operated — Wool Washing and Cleaning Machines, Fans for drying. Willow; Rolls for white wool; Washers, Fans and Rolls for colored. Cards, Gill Boxes, Preparing Frames and Cap Spinning Frames. Doubling Frames and Ball Winders.

Complete Test — 4 days. 4 indicators. 800 indicator cards. 5 operators.

First Test.

Mill Oils. **Full Mill Load.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, March 2, ...	377.0	330.5	160	355.5	46.5	13.1
Friday, March 3, ...	365.0	315.9	160	340.7	49.1	14.4
				348.1		

Difference of Averages 14.8 H.P. or 4.2 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, Nov. 9, ...	346.6	305.4	160	330.6	41.2	12.5
Friday, Nov. 10, ...	359.3	303.9	160	339.0	45.4	13.4
				334.8		

Difference of Averages 8.4 H.P. or 2.5 per cent. on Average of Test.

Engine and Transmission Load.

The tests of Engine and Transmission taken during the first test were found to be higher than the load usually credited to this item. An investigation was made and it was found that during these trials some drying fans in the dye-house had been in operation. The Engine and Transmission tests were therefore repeated, great care being exercised that only the Transmission was running. The same precaution was taken during the second test.

Mill Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, March 16, ...	115.8	105.8	40	110.4	10.0	9.1
Friday, March 17, ...	113.7	108.2	40	111.7	5.5	4.9
				111.1		

Difference of Averages 1.3 H.P. or 1.2 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, Nov. 9, ...	101.6	96.2	40	99.3	5.4	5.4
Friday, Nov. 10, ...	108.3	87.6	40	99.7	20.7	20.8
				99.5		

Difference of Averages .4 H.P. or .4 per cent. on Average of Test.

Result.

Full Mill Load.

			I.H.P.
MILL OILS.— Average of March 2, 3, 1905, ...			348.1
NEW OILS.— November 9, 1905. Actual H.P., . .	330.6		
Deduct machines working but stopped on first test,	4.0		
Corrected H.P., ...		326.6	
November 10, 1905. Actual H.P., ...	339.0		
Deduct machines working but stopped on first test,	18.6		
Corrected H.P.		320.4	
Corrected Average November 9 and 10, 1905, ...			323.5
Reduction, ...			24.6

or 7.1 per cent.

Engine and Transmission Load.

MILL OILS. — Average of March 16, 17, 1905, ...	111.1
NEW OILS. — Average of November 9, 10, 1905, ...	99.5
Reduction, ...	11.6

or 10.4 per cent.

Speeds.

Engine, Line Shaft and Spindles.

	Engine.	Shaft.	Spindles.
Mill Oils.— Average of March 2, 3, 1905, ...	76.37	104.7	2188.2
New Oils.— Average of November 9, 10, 1905, ...	76.00	104.85	2179.0

Revolution of Shaft to one of Engine. MILL OILS, ...	1.371	
Revolution of Shaft to one of Engine. NEW OILS, ...	1.380	
Increase, ...	.009	Rev.
Revolution of Spindles to one of Engine. MILL OILS, ...	28.65	
Revolution of Spindles to one of Engine. NEW OILS, ...	28.67	
Increase, ...	.02	Rev.

The Counts spun and Material manufactured were about the same during both tests.

Average Temperature and Relative Humidity.

	Temperature Degrees Fahr.	Relative Humidity. Per Cent.
Mill Oils.—March 2, 3, 1905,	71.1	52.2
New Oils.—November 9, 10, 1905,	70.3	55.2

Both Temperature and Relative Humidity slightly against a Reduction in Power.

Test No. 6. Test Made at Burnley, Lancashire, England.

WEAVING MILL TEST.

Engine—Roberts & Sons, Ltd., Nelson. Tandem Compound Corliss Engine, developing up to 550 H.P. at 53 R. P. M. Steam pressure 90 lbs.

Machinery Operated—Looms for cotton (4 to the H.P.), Winding Machines, Tape Machines, Slashing Machines, Beaming Machines, Finishing Machines.

Complete Test—4 days. 4 indicators (subdivisional test). 800 indicator cards. 4 operators.

Mill Oils. **First Test.—Full Mill Load.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent on average of day.
Wednesday, November 9,	516.6	453.4	160	492.2	63.2	12.8
Thursday, November 10,	525.5	490.2	160	509.8	35.3	6.9
				501.0		

Difference of Averages 17.6 H.P. or 3.5 per cent. on Average of Test.

New Oils. **Second Test.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, March 8,	473.3	427.4	160	456.2	45.9	10.0
Thursday, March 9,	478.6	429.8	160	451.1	48.8	10.8
				453.6		

Difference of Averages 5.1 H.P. or 1.1 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS. — Average of November 9, 10, 1904, (deduct machine correction of 6 H.P.,)	495.0
NEW OILS. — Average of March 8, 9, 1905, ...	453.6
Reduction, ...	41.4

or 8.4 per cent.

Engine.—Transmission Load.

Transmission was lubricated with a good grade of grease.

Mill Oils. **Shafting.**

Date.	Time.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Nov. 9	12.35 to 12.45	142.3	136.1	40	137.9	6.2	4.5
Nov. 10	12.35 to 12.45	165.0	140.3	40	155.2	24.7	15.9
					146.6		

Difference of Averages 17.3 H.P. or 11.8 per cent. on Average of Test.

New Oils.

Date.	Time.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of test.
March 8	12.35 to 1.02	131.2	125.4	40	127.5	5.8	4.5
March 9	12.43 to 12.48	131.1	124.2	40	127.6	6.9	5.4
					127.5		

Difference of Averages 0.1 H.P. or 0.08 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS. — Average of November 9, 10, 1904, ...	146.6
NEW OILS. — Average of March 8, 9, 1905, ...	127.5
Reduction, ...	19.1

or 13.0 per cent.

Temperature and Relative Humidity.

Averages from half hour readings during tests.

	Degrees Fahr. Temperature.	Relative Humidity Per Cent.
Wednesday, November 9, 1904,	69.6	66.5
Thursday, November 10, 1904,	67.4	62.1
Wednesday, March 8, 1905,	62.4	62.2
Thursday, March 9, 1905,	64.0	61.3

Temperature against a Reduction in Power.
Relative Humidity in favor of a Reduction in Power.

Test No. 7. Test made at Belfast, Ireland.

LINEN SPINNING MILL TEST.

Engines — Victor Coates, Belfast in 1902. Compound Vertical. Cylinders 12″ and 24″ diameter, 24″ stroke. Steam Pressure 140 lbs. 101 R.P.M. Developing about 100 H.P.

Machinery Operated — Dressing, Cropping, Spinning, Winding, Warping and Looms, as usual for manufacture of high grade Linen goods.

Complete Tests — 4 days. 4 indicators. 920 indicator cards. 4 operators.

The special features of this test are the very extensive observations made upon the temperature conditions of 731 individual shaft bearings, the observations covering a period of eight days under each class of lubrication. At the time of making the observations of the bearing, temperature readings were also taken of the temperature of the room, so that the rise or actual temperature due to friction could be secured.

As more Looms were in operation during the second test than on the first a special sub-divisional test was made in order to secure the power for correction so that both tests could be placed upon a comparative basis. The Machine Stoppages and extra Looms — the H.P. value being secured by the means stated — represent the following:

	I.H.P.	I.H.P.	I.H.P.
Wednesday, April 11, 1906, Stoppages,	23.91		
Thursday, April 12, 1906, Stoppages,	24.10		
Average,		24.00	
Wednesday, September 5, 1906,	9.15		
Thursday, September 6, 1906,	15.21		
Average,		12.18	
Difference to be added to first test,			11.82

First Test.

Mill Oils. **Full Mill Load.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, April 11, ...	111.0	78.0	160	93.9	33.0	35.1
Thursday, April 12, ...	110.9	92.5	160	103.9	18.4	17.7
				98.9		

Difference of Averages 10.0 H.P. or 10.1 per cent. on Average of Test.

New Oils. **Second Tests.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, September 5, . .	98.4	85.3	160	93.1	13.1	14.1
Thursday, September 6, . .	100.4	87.0	160	93.1	13.4	14.4
				93.1		

Difference of Averages 0. H.P. or 0. per cent. on Average of Test.

Mill Oils. **Engine and Transmission.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, April 11, ...	57.20	46.70	40	51.1	10.50	20.7
Thursday, April 12, ...	51.45	44.19	40	48.7	7.26	14.9
				49.9		

Difference of Averages 2.4 H.P. or 4.8 per cent. on Average of Test.

New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, September 5, . .	40.59	36.62	40	38.5	3.97	10.3
Thursday, September 6, . .	40.10	37.53	40	38.7	2.57	6.6
				38.6		

Difference of Averages .2 H.P. or 0.5 per cent. on Average of Test.

Result.

Full Mill Load.

	I.H.P.
MILL OILS.—Average of April 11, 12, 1906 (add 11.8 H.P. for Machinery Correction, machines not working during the first test but working during the second test), ...	110.7
NEW OILS.—Average of September 5, 6, 1906, ...	93.1
Reduction, ...	17.6

or 15.9 per cent.

Engine and Transmission.

	I.H.P.
MILL OILS.—Average of April 11, 12, 1906, ...	49.9
NEW OILS.—Average of September 5, 6, 1906, ...	38.6
Reduction, ...	11.3

or 22.7 per cent.

Temperature.

Being the average temperature of the bearing above the temperature of the surrounding atmosphere.

	Degree Fahr.
MILL OILS and GREASE.—Average of June, 1906. Actual frictional heat of 731 bearings, ...	12.20
NEW OILS.—Average of July, 1906. Same bearings, ...	4.12
Reduction in frictional heat, ...	8.08

Test No. 8. Test Made at Aberdeen, Scotland.

TEST ON TWO WOOLLEN MILLS.

The mills are usually driven by a water wheel and two engines. For convenience during the tests the water wheel was stopped. The smaller engine is called No. 1 and the larger engine No. 2. No. 2 Engine was coupled up to take the load usually driven by the water wheel.

No. 1 Engine—Hicks, Hargreaves, Ltd., Bolton. Horizontal Tandem Compound; Corliss Valves; 13″ and 24″ x 36″ stroke; 83 R. P. M. Steam Pressure 120 lbs. Developing about 250 H.P.

Machinery Operated—Spinning, carding and dye-house with washing machines.

No. 2 Engine—Hicks, Hargreaves, Ltd., Bolton. Horizontal Tandem Compound. Corliss Valves. 18″ and 33″ x 40″ stroke. 74 R.P.M. Steam Pressure 120 lbs. Developing about 400 H.P.

Machinery Operated—Warping, scouring, spinning, teazing, carding, weaving and finishing machines.

Complete Test—12 days. 4 indicators. 2,400 indicator cards. 6 operators.

No. 1 Engine.

Mill Oils. **Full Mill Load.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, October 4, . . .	190.0	150.6	160	173.2	39.4	22.8
Wednesday, October 5, . . .	194.1	156.7	160	176.5	37.4	21.2
Thursday, October 6, . . .	192.3	158.4	160	178.8	33.9	19.0
				176.1		

Difference of Averages 5.6 H.P. or 3.2 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 17, . . .	198.0	149.8	160	172.4	48.2	28.0
Wednesday, January 18, . . .	198.4	141.5	160	171.8	53.9	31.4
Thursday, January 19, . . .	198.2	143.8	160	173.0	54.4	31.4
				172.4		

Difference of Averages 1.2 H.P. or 0.7 per cent. on Average of Test.

Mill Oils. **Engine and Transmission Load.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, October 4, . . .	60.8	56.2	40	58.4	4.6	7.9
Wednesday, October 5, . . .	66.3	60.2	40	63.6	6.1	9.6
Thursday, October 6, . . .	67.5	57.5	40	63.4	10.0	15.7
				61.8		

Difference of Averages 5.2 H.P. or 8.4 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 17, . . .	60.6	49.6	40	54.2	11.0	20.3
Wednesday, January 18, . . .	62.7	55.3	40	57.6	7.4	12.8
Thursday, January 19, . .	60.0	53.2	40	56.4	6.8	12.0
				56.1		

Difference of Averages 3.4 H P. or 6.0 per cent. on Average of Test.

Result.—No. 1 Engine.

Mill Oils. **Full Mill Load.**

Tuesday, October 4. — Machine correction, ... 7.5 H.P.
Wednesday, October 5. — Machine correction, ... 0.0 "
Thursday, October 6. — Machine correction, ...1 "
Corrected Average of the three days, ... 173.4 "
Average of Wednesday and Thursday where no corrections are needed, ... 177.7 "

New Oils.

Tuesday, January 17. — Deduct for dynamo in P. M., ... 25.2 "
Wednesday, January 18. — Deduct for dynamo in P. M., ... 17.9 "
Thursday, January 19. — Deduct for dynamo in P. M., ... 13.5 "
Corrected Average of the three days, ... 163.0 "
Average of Wednesday and Thursday, ... 164.6 "

	I.H.P.
MILL OILS. — Average of October 4, 5, 6, 1904. Corrected basis, . .	173.4
NEW OILS. — Average of January 17, 18, 19, 1905. Correct basis, . .	163.0
Reduction, ...	10.4

or 6.0 per cent. (not included in Summary of this Test).

MILL OILS. — Average of October 5 and 6. No corrections, ...	177.7
NEW OILS. — Average of January 18 and 19. Corrections for dynamo in P. M., ...	164.6
Reduction, ...	13.1

or 7.4 per cent. (included in Summary of this Test), or on a straight basis, no corrections.

MILL OILS. — Average of October 4, 5, 6, 1904. Morning loads only	177.9
NEW OILS. — Average of January 17, 18, 19, 1905. Morning loads only	164.6
Reduction, ...	13.3

or 7.5 per cent.

No. 1. Engine and Transmission.

MILL OILS. — Average of October 4, 5, 6, 1904, ... 61.8
NEW OILS. — Average of January 17, 18, 19, 1905, ... 56.1
Reduction, ... 5.7
or 9.2 per cent.

Speeds.

MILL OILS, 1904.	Engine.	Mule Spindles.	Revolutions of Spindles to One of Engine.	Shaft Speed.	Revolutions of Shaft to One of Engine.
Tuesday, October 4, . .	82.72	2383	28.79	174.75	2.11
Wednesday, October 5, . .	82.58	2365	29.02	175.10	2.11
Thursday, October 6, . .	82.65	2399	29.02	175.10	2.11
Average	82.65	2383	28.95	174.98	2.11
NEW OILS, 1905.					
Tuesday, January 17, . .	83.00	2405	28.97	176.15	2.12
Wednesday, January 18, . .	82.93	2434	29.35	176.00	2.12
Thursday, January 19, . .	82.90	2456	29.63	175.95	2.12
Average	82.94	2432	29.32	176.03	2.12

Countershaft.

MILL OILS. — October 4, 5, 6, 1904. Average number of revolutions of shaft to one of Engine, ... R.P.M. 2.11
NEW OILS. — January 17, 18, 19, 1905. Average number of revolutions of shaft to one of Engine, ... 2.12
Speed increased 0.5 per cent.

Mule Spindles.

MILL OILS. — October 4, 5, 6, 1904. Average number of revolutions of spindles to one of Engine, ... 28.82
NEW OILS. — January 17, 18, 19, 1905. Average number of revolutions of spindles to one of Engine, ... 29.32
Speed increased 1.7 per cent.

Average Temperatute and Relative Humidity.

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
Mill Oils, October 4, 5, 6, 1904, ...	60.0	69.9
New Oils, January 17, 18, 19, 1905, . .	64.5	47.9

Both Temperature and Relative Humidity are in favor of a Reduction in Power.

Counts Spun.

The Mill Management reports this item of load the same during both tests.

No. 2 Engine.

Mill Oils. **Full Mill Load.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, October 11 . . .	389.0	335.4	160	364.2	53.6	14.7
Wednesday, October 12 . . .	401.6	339.8	160	368.0	61.8	16.8
Thursday, October 13 . . .	399.8	338.0	160	365.5	61.8	16.9
				365.9		

Difference of Averages 3.8 H.P. or 1.0 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. of average of day.
Tuesday, January 24 . . .	323.5	273.0	160	300.8	50.5	16.7
Wednesday, January 25 . . .	344.3	284.0	160	311.1	60.3	19.4
Thursday January 26 . . .	332.3	273.0	160	304.8	59.0	19.4
				305.5		

Difference of Averages 10.3 H.P. or 3.4 per cent. on Average of Test.

No. 2 Engine and Rope Race.

Mill Oils, 1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average per day.
Saturday, October 8	108.5	97.3	40	101.1	11.2	11.1
New Oils, 1905.						
Tuesday, January 24	97.7	92.4	40	95.4	5.3	5.6
Thursday, January 26	100.0	90.5	40	93.2	9.5	10.2
				94.3		

No. 2 Engine, Rope Race and All New and Old Mill Shafting.

(Transmission).

Mill Oils, 1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Saturday, October 8	169.8	161.1	40	166.9	8.7	5.2
Thursday, October 11	170.6	160.9	40	161.8	9.7	6.0
				164.3		
New Oils, 1905.						
Thursday, January 26	151.1	143.3	40	147.3	7.8	5.3

Result.—No. 2 Engine.

Mill Oils. **Full Mill Load.**

Tuesday, October 11. — Machine correction, ... 36.3 H.P.
Wednesday, October 12. — Machine correction, ... 41.2 "
Thursday, October 13. — Machine correction, ... 44.9 "

I.H.P.
Corrected Average of the three days, ... 325.1

New Oils.

Tuesday, January 24. — Deduct for dynamo in P. M., ... 28.0 H.P.
Wednesday, January 25. — Deduct for dynamo in P. M., ... 28.0 "
Thursday, January 26. — Deduct for dynamo in P. M., ... 16.8 "

I.H.P.
Corrected Average for the three days, ... 293.5

Mill Oils. — Average of October 11, 12, 13. Comparative load, . 325.1
New Oils. — Average of January 24, 25, 26. Comparative load, . . 293.5

Reduction, ... 31.6
or 9.7 per cent.

Engine and All Transmission.

(New and Old Mill).

Mill Oils. — October 8, 1904. Comparative load (less 3 H.P.) 161.4
New Oils. — January 26, 1905. Comparative load, ... 147.3

Reduction, ... 14.1
or 8.7 per cent.

Engine and Rope Race Only.

Mill Oils. — October 8, 1904, ... 101.1
New Oils. — January 24, 26, 1905, ... 94.3

Reduction, ... 6.8
or 6.7 per cent.

Speeds.

Mill Oils, 1904.	Engine.	Doubling Spindles.	Revolutions of Spindles to One of Engine.	Shaft Speed.	Revolutions of Shaft to One of Engine.
Tuesday, October 11 . .	74.27	3417	46.00	177.75	2.39
Wednesday, October 12 . .	73.00	3462	47.42	177.25	2.42
Thursday, October 13 . .	76.81	3563	46.38	179.35	2.33
Average	74.69	3481	46.6	178.12	2.38
New Oils, 1905.					
Tuesday, January 24 . .	74.80	3543	47.36	179.4	2.39
Wednesday, January 25 . .	75.05	3572	47.59	179.9	2.39
Thursday, January 26 . .	75.10	3577	47.63	180.4	2.40
Average	74.98	3564	47.53	179.9	2.39

Line Shaft.

Mill Oils. — October 11, 12, 13, 1904. Average number of revolutions of shaft to one of Engine, ... R.P.M. 2.38

New Oils. — January 24, 25, 26, 1905. Average number of revolutions of shaft to one of Engine, ... 2.39

Speed increased 0.42 per cent.

Doubling Spindles.

Mill Oils. — October 11, 12, 13, 1904. Average number of revolutions of Spindles to one of Engine, ... 46.60

New Oils. — January 24, 25, 26, 1905. Average number of revolutions of Spindles to one of Engine, ... 47.53

Speed increased 2.0 per cent.

Average Inside Temperature and Relative Humidity.

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
Mill Oils, October 11, 12, 13, 1904, . .	59.0	70.0
New Oils, January 24, 25, 26, 1905, . .	58.3	65.3

Temperature against a Reduction in Power.

Relative Humidity in favor of a Reduction in Power.

Counts Spun.

Mill Management reports no load difference due to this item.

Summary of Result of Test on Engines 1 and 2.

No. 1 Engine.

	Per Cent.
Reduction on the Full Load,	7.4
Reduction on the Engine and Transmission,	9.2
Increase in the Speed of Mule Spindles,	1.7
Increase in the Speed of Counter Shaft,	.5

No. 2 Engine.

	Per Cent.
Reduction on the Full Load,	9.7
Reduction on the Engine and Transmission,	8.7
Reduction on the Engine and Rope Race Load,	6.7
Increase in the Speed of Doubling Spindles,	2.0
Increase in the Speed of Line Shaft,	.4

Test No. 9. Test made at Rheydt, Germany.

POWER TEST OF A GERMAN COTTON SPINNING MILL.

Engine — Made by the Maschinenfabrik O. Recke, Rheydt, in 1903. Compound (Cross) Condensing. Cylinders 400 m/m and 625 m/m by 700 m/m stroke. Normal rating 260 P.S. (Pferdestrake = H.P.)

Machinery Operated — Openers, Cards, Flyers and all intermediate frames. 4,500 Mule Spindles. 1,960 Ring Spindles. 70 Looms and all intermediate machines.

Complete Test — 6 days. 4 indicators. 1,360 indicator cards. 3 operators.

First Test.

Mill Oils. **Full Mill Load.**

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Wednesday, June 14, ...	282.9	224.1	200	256.9	58.8	23.0
Thursday, June 15, ...	277.7	220.8	200	257.4	56.9	22.0
Friday, June 16, ...	279.2	239.9	200	258.3	39.3	15.2
				257.6		

Difference of Averages 1.6 P.S. or 0.62 per cent. on Average of Test.

New Oils.

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Wednesday, September 6, . .	247.2	180.2	184	214.0	67.0	31.3
Thursday, September 7, . .	250.0	189.1	200	232.2	60.9	26.2
Friday, September 8, . .	250.8	215.5	200	234.2	35.3	15.0
				225.99		

Difference of Averages 20.2 P.S. or 9 per cent. on Average of Test.

Mill Oils. **Engine and Transmission and Ring Spinning.**

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Thursday, June 15, ...	118.6	111.3	24	116.1	7.3	6.3
Friday, June 16, ...	114.2	109.5	48	111.9	4.7	4.2
				114.03		

Difference of Averages 4.2 P.S. or 3.7 per cent. on Average of Test.

New Oils.

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Thursday, September 7, . . .	97.8	92.3	52	95.00	5.5	5.80
Friday, September 8, .	100.5	95.6	52	99.21	4.9	4.95
				97.11		

Difference of Averages 4.21 P.S. or 4.4 per cent. on Average of Test.

Temperature and Relative Humidity.

1905.	Temperature. Degrees Centigrade.	Relative Humidity. Per Cent.
Wednesday, June 14, ...	22.0	56.2
Thursday, June 15, ...	23.7	60.3
Friday, June 16, ...	25.0	61.8
Average, ...	23.5	59.4
Wednesday, September 6, . . .	22.5	80.2
Thursday, September 7, . . .	22.4	67.9
Friday, September 8, . . .	19.5	72.2
Average, ...	21.4	73.4

Speeds.

For these records spindles were tested on seven frames.

Ring Spindles.

MILL OILS.— Average R. P. M. of Spindles, ... 8875.0
NEW OILS.— Average R. P. M. of Spindles, ... 8904.0

Increase in Speed, ... 29.0 R.P.M.
or 0.3 per cent.

Mule Spindles (Selfaktoren).

MILL OILS.— Average R. P. M. of Spindles, ... 7283.0
NEW OILS.— Average R. P. M. of Spindles, ... 7544.3

Increase in Speed, ... 261.3 R.P.M.
or 3.6 per cent.

Engine Speeds.

	Morning.	Afternoon.		Morning.	Afternoon.
Wednesday, June 14, . . .	114.6	115.7	September 6,	119.0	118.9
Thursday, June 15, . . .	117.9	118.4	September 7,	117.7	118.1
Friday, June 16, . . .	117.0	116.6	September 8,	118.7	117.2
Average, ...	116.5	116.9		118.5	118.0

	Engine R. P. M.	Mule Spindles R. P. M.	Rev. of Spindles to one of Engine.
Mill Oils, ...	116.70	7283.0	62.4
New Oils, ...	118.25	7544.3	63.7
Increase, ...	1.55	261.3	1.3

Results.

Full Mill Load.

	I.P.S.
MILL OILS.— Average of June 14, 15, 16, 1905, (add Machine Correction of 5.81 P.S.)	263.41
NEW OILS.— Average of September 6, 7, 8, 1905, (add Machine Correction of 13.36 P.S.)	239.35
Reduction, ...	24.06

or 9.1 per cent.

Engine Transmission and Ring Spinning,

MILL OILS.— Average of June 15, 16, 1905, ...	114.03
NEW OILS.— Average of September 7, 8, 1905, ...	97.11
Reduction, ...	16.92

or 14.8 per cent.

Conclusion.

The full load on this Cotton Mill was reduced by means of better lubrication, ...	24.06 P.S. or 9.1 per cent.
The load on the Engine, Transmission and Ring Spinning was reduced, ...	16.92 P.S. or 14.8 per cent.
The load and the balance of the mill was reduced, .	7.84 P.S. or 5.2 per cent.
The speed of the Mule Spindles was increased, . .	3.6 per cent.
The speed of the Ring Spindles increased, ...	0.3 per cent.
The speed of the Engine increased, ...	1.55 R.P.M. or 1.3 per cent.

This would represent an increase in production, as the production of a mill is largely dependent upon its speed.

Both the Relative Humidity and Temperature are against a Reduction in Power.

Test No. 10. Test made at Elberfeld, Germany.

POWER TEST OF A WORSTED SPINNING AND WEAVING MILL.

Engine — Made by Gebruder Selzer, Winterthur, Switzerland, 1890. Tandem Compound Condensing. Cylinders 475 m/m and 570 m/m. Hub (Stroke) 1,050 m/m. Steam Pressure 8 to 9 atmospheres. Temperature at Cylinder 260–270 °C., 70 R. P. M., developing about 320.0 P.S.

Machinery Operated — Preparing, roving, washing, weaving and finishing machinery for preparing and manufacturing woolen and worsted goods.

Complete Test — 9 days. 4 indicators. 1,764 indicator cards. 3 operators.

The first test was made upon the basis of very cheap American and Russian Oils. The engine was overloaded and more machinery was to be put in the mill. It was a question whether to buy a 30 P.S. electric motor, or buy better lubricating oil. The following test was made to show the effect of changing the oil. As the second test was made in the summer, and the temperature in and outside were so greatly in favor of the reductions shown by the second test, it was decided to run a third test to secure data in regard to the effect of the temperature and humidity. An attempt will be made to show this effect, though it must be remembered that the effect has been on this one mill, and it is not claimed to represent what will follow in every mill.

First Test.

Mill Oils. **Full Mill Load.**

1906.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, March 20, . . .	329.4	305.8	160	319.0	23.6	7.4
Wednesday, March 21, . . .	344.6	311.0	160	325.5	33.6	10.3
Thursday, March 22, . . .	340.6	295.3	160	320.8	45.3	14.1
				321.79		

Difference of Averages 6.5 P.S. or 2 per cent. on Average of Test.

Second Test.

New Oils.

1906.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, June 26, ...	304.8	263.7	160	284.0	41.1	14.5
Wednesday, June 27, ...	291.8	256.7	160	276.6	35.1	12.7
Thursday, June 28, ...	290.2	260.2	160	274.3	30.0	11.0
				278.3		

Difference of Averages 9.7 P.S. or 3.5 per cent. on Average of Test.

Engine and Transmission.

1906.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
MILL OILS.						
Tuesday, March 20, midday	121.4	112.6	60	117.40	8.8	7.5
Thursday, March 22, midday	124.5	115.8	40	119.10	8.7	7.3
Wednesday, March 21, morning	148.7	138.0	40	141.29	10.7	7.6
NEW OILS.						
Tuesday, June 26, midday .	98.5	94.7	40	97.2	3.8	3.9
Thursday, June 28, midday .	95.8	92.4	40	94.1	3.4	3.6
Wednesday, June 27 morning	109.7	103.9	40	106.8	5.8	5.4

Result.

Full Mill Load.

		I.P.S.
MILL OILS.—Average of March 20, 21, 22, 1906, . . .	321.79 (add	
Machine correction of	19.57= . . .	341.36
NEW OILS.—Average of June 26, 27, 28, 1906, ...	278.33 (add	
Machine correction of	12.2 = . . .	290.53
Reduction, ...		50.83

or 14.9 per cent.

Engine and Transmission.

	I.P.S.
MILL OILS.— Average of March 20, 22, 1906,	118.24
NEW OILS.— Average of June 26, 28, 1906,	95.67
Midday Reduction,	22.57
or 19.1 per cent.	

MILL OILS.— Average of March 21, 1906,	141.29
NEW OILS.— Average of June 27, 1906,	106.80
Morning Reduction,	34.49
or 24.4 per cent.	

Temperature of Guide on Engine.

Readings made every half hour for three days during test.

Mill Oils.

1906.	Room Temperature °C	Guide. °C	Difference. °C
Tuesday, March 20,	27.6	67.6	40.0
Wednesday, March 21,	27.0	63.4	36.4
Thursday, March 22,	25.9	61.0	35.1
Average Temperature of Friction,			37.1 °C.

New Oils.

1906.	Room Temperature °C	Guide. °C	Difference. °C
Tuesday, June 26,	32.0	57.0	25.0
Wednesday, June 27,	35.1	59.4	24.3
Thursday, June 28,	33.2	60.1	26.9
Average Temperature of Friction,			25.4 °C.

Reductions.

Temperature (Actual due to Friction) Guide of Engine.

MILL OILS.— Average of three days,	37.1 °C.
NEW OILS.— Average of three days,	25.4
Reduction,	11.7 °C.
or 31.5 per cent.	

Spindle Rail Temperatures.

These temperatures were taken from three frames every half hour for each of the six days of test. The room temperature at each frame was also taken. The difference between the temperature of the spindle and the temperature of the room is the heat due to friction.

Averages of Frictional Heat Only.

MILL OILS.				NEW OILS.			
1906.	SPINNING FRAMES. 2	3	4	1906.	SPINNING FRAMES. 2	3	4
March 20 . .	11.9	11.4	12.7 °C	June 26 . .	6.5	3.7	7.2 °C
March 21 . .	11.4	10.0	10.7	June 27 . .	4.6	2.7	5.8
March 22 . .	12.3	10.9	12.2	June 28 . .	6.4	3.3	4.2
Averages . .	11.8	10.8	11.8 °C	Averages .	5.8	3.2	5.7 °C

	SPINNING FRAMES. 2	3	4
MILL OILS.— Averages March 20, 21, 22, . . .	11.8	10.8	11.8 °C.
NEW OILS.— Averages June 26, 27, 28, ...	5.8	3.2	5.7
Reductions, ...	6.0	7.6	6.1 °C.
	or 51%	or 70%	or 52%

Mill Oils. **Speeds.**

1906.	Engine.	SPINDLES. Second Floor Average for the Test.		Rev. of Spindles to one of Engine.
Tuesday, March 20, ...	69.25			
Wednesday, March 21, ...	69.23			
Thursday, March 22, ...	69.28			
	69.25	1982	=	28.60
New Oils.				
Tuesday, June 26, ...	69.43			
Wednesday, June 27, ...	69.45			
Thursday, June 28, ...	69.45			
	69.44	2012	=	29.0

Increase, ... 0.4 R.P.M.
or 1.4 per cent.

Temperature and Relative Humidity.

1906.	Temperature. Outside.	Temperature. Inside.	Relative Humidity. Spinning Room.
Mill Oils.			
Tuesday, March 20	5.0 °C	16.6 °C	56 Per Cent.
Wednesday, March 21	4.0	13.8	58 " "
Thursday, March 22	3.4	13.3	58 " "
Average	4.13 °C	14.56 °C	57.3 " "
New Oils.			
Tuesday, June 26	20.7 °C	21.6 °C	65.0 Per Cent.
Wednesday, June 27	26.4	25.6	58.4 " "
Thursday, June 28	22.4	23.6	63.4 " "
Average	23.17 °C	23.6 °C	62.27 " "

Both Room Temperature and outside Temperature are greatly in favor of a reduction in friction.

The Relative Humidity during the second test (62.27 per cent.) was 4.97 per cent. higher, which would mean that the power should be higher, due to this cause, than during the first test, if everything else was equal.

As this test stands, however, the higher Relative Humidity probably will equalize the effect of the considerable increase in Room Temperature.

Third Test.

(Same Lubrication as during Second Test.)

New Oils. **Full Mill Load.**

1906.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, November 13 . .	314.9	285.3	200	299.3	29.6	9.8
Wednesday, November 14 . .	309.7	283.6	200	301.6	26.1	8.5
				300.5		

Difference of Averages 2.3 P.S. or 8 per cent. on Average of Test.

Engine and Transmission.

New Oils. (Noon.)

1906.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, November 13 . .	109.9	102.9	48	105.1	7.0	6.6
Wednesday, November 14 . .	109.8	102.2	48	105.7	7.6	7.2
				105.4		
(Morning Before Work.)						
Wednesday, November 14 . .	123.2	110.9	48	119.3	12.3	10.3

Complete Results of the First, Second and Third Tests.

Full Test on Corrected Basis.

1906.	Average P. S.			Temperatures.			Speeds.		
	All Days Full Load.	Transmission. A. M.	Transmission. P. M.	Outside.	Room °C	Spindle °C	Rel'tive Per C't Humidity.	Engine R.P.M.	Spindle R.P.M.
1st Test.–Mill Oils.									
Tuesday, Mar. 20,	344.1		117.4	5	18.6	30.6	56	69.25	
Wednesday, Mar. 21,	343.1	141.3		4	17.3	28.0	58	69.23	1982
Thursday, Mar. 22,	336.9		119.1	3.4	16.0	27.8	58	69.23	
Average . . .	341.36	141.3	118.24	4.13	17.3	28.8	57.33	69.23	1982
2d Test.– New Oils.									
Tuesday, June 26,	301.0		97.2	20.7	22.5	28.3	65	69.43	2012
Wednesday, June 27,	284.1	106.8	94.1	26.4	27.8	32.1	58.4	69.45	
Thursday, June 28,	286.3			22.4	25.0	29.3	63.4	69.45	
Average . . .	290.46	106.8	95.6	23.16	25.1	29.9	62.27	69.44	2012
3d Test.– New Oils.									
Tuesday, Nov. 13,	298.5		105.1	8.9	19.1	22.4	62.3	69.16	2055
Wednesday, Nov. 14,	300.0	119.3	105.7	9.7	19.8	22.8	61.7	69.39	
Average . . .	299.30	119.3	105.4	9.3	19.45	22.6	62.0	69.27	2055

Averages of the Three Tests.

	Full Load. P. S.	Transmission. A. M.	Transmission. P. M.	Temperatures. Outside	Temperatures. Room °C	Temperatures. Spindle °C	Rel'tive Per Cent. Humidity.	Speeds. Engine	Speeds. Spindles
First Test . .	341.36	141.9	118.24	4.33	17.3	28.8	57.33	69.23	1982
Second Test .	290.46	106.8	95.60	23.16	25.1	29.9	62.27	69.44	2012
Third Test . .	299.30	119.3	105.41	9.30	19.5	22.6	62.00	69.27	2055

Results Between the First Test and the Third Test.

Full Mill Load.

	I.P.S.
MILL OILS.— Average for test,	341.36
NEW OILS.— Average for test,	299.30
Reduction,	42.06

or 12.3 per cent.

Engine and Transmission.

Morning's Load.

	I.P.S.
MILL OILS.—Average,	141.29
NEW OILS.—Average,	119.28
Reduction,	22.01

or 15.57 per cent.

Noon Load.

	I.P.S.
MILL OILS.—Average,	118.24
NEW OILS.—Average,	105.41
Reduction,	12.83

or 10.85 per cent.

The Effect of Temperature or the Difference Between the Second and Third Tests.

The Humidity was practically the same,	62.27 per cent. for the Second Test
and,	62.0 per cent. for the Third Test.
A reduction of,	13.86 °C. (59.8 per cent.)
Outside temperature effects the inside temperature so that it falls,	5.56 °C. (22.2 per cent.)
This reduction in room temperature increases the total power,	8.86 P.S. or 3 per cent.

On this one mill it appears that a reduction in room temperature of 5.56 °C. increases the power 3 per cent.

This is not allowing for the fact that the bearings always run to better advantage after having been lubricated with a good oil. This is proven by the fact that the actual temperatures of the spindles (the difference between the total temperature and the room temperature), which is a good indication of their frictional losses, were 11.5 °C. for the first test, 4.8 °C. for the second test, and 3.15 °C. for the third test.

Test No. 11. Test made at Ostritz, Germany.

POWER TEST ON A JUTE SPINNING AND WEAVING MILL.

Engine—Compound Engine by Hartmann, Chemnitz. Engine having Poppet Valves. Steam Pressure 7 Atmospheres, 63 R. P. M. 1,000 P. S.

Machinery Operated—Preparing, spinning and weaving with all intermediate machines, for the purpose of making heavy jute bagging and stuff.

Complete Test—6 days. 4 indicators. 1,056 indicator cards. 3 operators.

First Test.

Mill Oils. **Full Mill Load.**

1904.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent on average of day.
Tuesday, December 20, . .	1208.5	1081.5	164	1142.6	127.0	11.0
Wednesday, December 21, . .	1192.3	1077.1	164	1131.5	115.2	10.2
Thursday, December 22, . .	1171.1	1053.1	120	1131.4	118.6	10.4
				1135.2		

Difference of Averages 11.2 P. S. or 1 per cent. on Average of Test.

New Oils. **Second Test.**

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, February 28, . .	1083.6	960.3	164	1021.4	123.3	12.0
Wednesday, March 1, . .	1090.5	991.8	164	1042.6	98.7	9.4
Thursday, March 2, . .	1069.0	979.4	120	1038.6	89.6	8.6
				1034.2		

Difference of Averages 23.5 P. S. or 2.3 per cent. on Average of Test.

Mill Oils. **Engine and Transmission.**

1904.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, December 20, . . .	373.8	348.5	40	363.5	25.3	7.0
Thursday, December 22, . . .	367.0	357.2	40	361.9	9.8	2.7
				362.6		

Difference of Averages 1.6 P. S. or 0.44 per cent. on Average of Test.

New Oils.

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Tuesday, February 28, . . .	337.8	323.9	40	328.7	13.9	4.2
Wednesday, March 1, . . .	353.4	337.6	40	347.4	15.8	4.6
				328.1		

Difference of Averages 18.7 P. S. or 3.7 per cent. on Average of Test.

Result.

Full Mill Load.

	I.P.S.
MILL OILS. — Average of December 20, 21, 22, 1904, ...	1,135.2
NEW OILS. — Average of February 28, March 1 and 2, 1905, ...	1,034.2
Reduction, ...	101.0

or 8.89 per cent.

Engine and Transmission.

	I.P.S.
MILL OILS. — Average of December 20, 22, 1904, ...	362.6
NEW OILS. — Average of February 28, March 1, 1905, ...	328.1
Reduction, ...	34.5

or 9.51 per cent.

Average Speeds of Engines.

Mill Oils.	9.00 to 11.30	2.00 to 3.20	4.40 to 5.20
December 20, 1904,	63.0	63.0	63.0
December 21,	63.1	63.0	63.3
December 22,	63.2	63.0	62.8
	63.1	63.0	63.0
New Oils.			
February 28, 1905,	62.8	63.4	63.4
March 1,	63.5	63.5	68.8
March 2,	63.6	63.2	
	63.3	63.4	63.6

	R.P.M.
MILL OILS. — First Test Average, ...	63.03
NEW OILS. — Second Test Average, ...	63.43
Increase in Speed, ...	.40

Mill Oils. **Temperature and Relative Humidity.**

December 20. Room Temperature, °C.	Relative Humidity Per Cent.	December 21. Room Temperature, °C.	Relative Humidity Per Cent.	December 22. Room Temperature, °C	Relative Humidity Per Cent.
20.5	67.5	21.2	70	20.0	70

New Oils.

February 28,		March 1,		March 2,	
19.1	68.5	18.8	69	18.9	70

Mill Oils. **Spindle Temperature. (Mules.)**

Temperatures.		Tuesday.			Wednesday.			Thursday.		
1st Test	Spindle °C	45.9	46.2	40.0	46.4	46.8	41.4	44.5	44.9	40.8
Dec. 1, 1904,	Room °C	20.5	20.5	20.5	21.2	21.2	21.2	20.0	20.0	20.0
Frictional Heat		25.4	25.7	19.5	25.2	25.6	20.2	24.5	24.9	20.8

New Oils.

Temperatures.		Tuesday.			Wednesday.			Thursday.		
2nd Test	Spindle °C	35.9	35.9	34.5	32.4	35.3	36.0	32.3	36.0	35.3
Feb. & Mar. 1905,	Room °C	19.1	19.1	19.1	19.1	18.8	18.8	18.8	18.9	18.9
Frictional Heat,		16.8	16.8	15.4	13.3	16.5	17.2	13.5	17.1	16.4
Reductions from 2nd test,		8.6	8.9	4.1	11.9	9.1	3.0	11.0	7.8	4.4
Percentage Reduction,		33.8	35.0	21.0	47.2	35.5	14.8	45.0	31.4	21.1

Average Reduction of Spindle Heat (Mules) . . . . . 31.5 per cent.
Same System of Readings give Reduction of Temperature on Both Spindles, ... 21.0 per cent.

Summary.

Reduction on the total load of the mill due to more perfect lubrication is, ... 101.0 P. S. or 8.89 per cent.
Reduction of the Engine and Transmission load . 34.5 P. S. or 9.51 per cent.
This reduction will insure the engine starting easier in the morning, and especially Monday morning.
Engine speed increases, ...39 R.P.M.
This represents an increased speed of . . . . . 6 per cent.
to the Mill and equals about that much increased production.
Temperature of all bearings tested reduced from 4.1 °C to 8.9 °C
due to better lubrication.
Relative Humidity was the same during both Tests.
Room Temperature against a Reduction in Power, to a slight extent.

Test No. 12 Test made at Schuja, Russia.

POWER TEST ON A COTTON SPINNING MILL IN RUSSIA.

Engine — Made by G. A. Lessner, St. Petersburg. Horizontal Triple. Expansion Engine: Condensing. 21¼″ and 34¼″ and 53″ x 54″ stroke. Steam Pressure 165 lbs. 65 R.P.M. Developing about 1,240 H. P.

Machinery Operated — Flyer, Ring and Selfactor Spinning, and all Preparatory Machines.

Complete Test — Of which the first five and last five days are given. 35 days. 6 indicators. 2,136 indicator cards. 2 operators.

First Test.

Mill Oils. **Full Mill Load.**

1903.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Monday, November 3, . .	1359.6	1201.4	108	1268.1	158.2	12.5
Tuesday, November 4, . .	1286.9	1176.1	108	1247.2	110.8	8.8
Wednesday, November 5, . .	1265.0	1143.6	108	1232.3	121.4	9.9
Thursday, November 6, . .	1241.5	1156.8	108	1211.7	84.7	7.0
Friday, November 7, . .	1277.0	1137.0	108	1234.5	140.0	11.3
				1238.8		

Difference of Averages 57.4 H.P. or 4.6 per cent. on Average of Test.

Second Test.

New Oils.

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, June 14	1150.1	1046.1	108	1091.1	104.0	9.5
Wednesday, June 15 . . .	1145.4	1026.8	108	1084.1	118.6	10.4
Thursday, June 16	1129.9	967.5	108	1064.5	162.4	14.3
Friday, June 17	1081.7	1000.8	108	1046.8	80.9	7.5
Saturday, June 18	1108.0	1022.9	108	1055.0	85.1	7.7
				1069.1		

Difference of Averages 44.3 H.P. or 4.2 per cent. on Average of Test.

Result of Power Test.

	I.H.P.
MILL OILS.— Average Nov. 3, 4, 5, 6, 7, 1903,	1,238.8
NEW OILS. — Average June 14, 15, 16, 17, 18, 1904,	1,069.1
Reduction,	1,69.7

or 13.7 per cent.

Speeds.

Flyer Spindles.

	R.P.M.
MILL OILS. — Average R. P. M.,	1,120
NEW OILS. — Average R. P. M.,	1,140
Increase,	20

or 1.8 per cent.

Ring Spindles.

	R.P.M.
MILL OILS. — Average R. P. M.,	8,046
NEW OILS. — Average R. P. M.,	8,417
Increase,	371

or 4.6 per cent.

Mule Spindles (Selfactors.)

	R.P.M.
MILL OILS.— Average R. P. M.,	10,400
NEW OILS.— Average R. P. M.,	10,550
Increase,	150

or 1.4 per cent.

Temperature.

	Spindle Bearing. °C.	Room Temp. °C.	Frict. Heat °C.	Reduction.	Per Cent.
Mill Oils,	36.9	32.6	4.3		
New Oils,	32.2	30.8	1.4		
				2.9	67.4

Average Temperature and Relative Humidity.

	Temperature °C.	Relative Humidity Per Cent.
Mill Oils,	32.6	42.3
New Oils,	30.8	48.4

Both Temperature and Relative Humidity are against a Reduction of Power.

Cost of Burning Material (Wood).

		Rubels.
MILL OILS.— From November, 1902 to March, 1903.	Average per day,	277.41
NEW OILS.— From November, 1903 to March, 1904.	Average per day,	244.64
Saving, ...		32.77

or 11.7 per cent.

Summary.

The power was reduced. . . . . 169.7 H.P. or 13.7 per cent.
The Speed of Flyer Spindles increased, ... 1.8 per cent.
The Speed of Ring Spindles increased, ... 4.6 per cent.
The Speed of Mule Spindles increased, ... 1.4 per cent.

This would represent an increase in production as the production of a mill is dependent upon its speed.

The daily cost on Burning Material was reduced, ... 11.7 per cent.

Test No. 13. Power Test made at Ahmedabad, India.

POWER TEST IN A COTTON SPINNING MILL IN INDIA.

Engine — Cross Compound. Corliss Valves. Cylinders 26″ and 44″ x 72″ stroke. Steam Pressure 110 lbs.52 R. P. M. Developing about 650 H.P.

Machinery Operated — Cotton Spinning Machinery with usual preparation machinery for 34,000 Ring Spindles.

Complete Test — 4 days. 4 indicators. 720 indicator cards. 3 operators.

First Test.

Mill Oils. **Full Mill Load.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, May 9	696.1	602.9	160	644.9	93.2	14.4
Thursday, May 10	679.3	608.4	160	640.3	70.9	11.1
				642.6		

Difference of Averages 4.6 H.P. or 7 per cent. on Average of Test.

New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, December 13 . . .	648.1	562.1	160	607.0	86.0	14.2
Friday, December 14 . . .	642.3	514.2	160	596.7	128.1	21.5
				601.9		

Difference of Averages 10.3 H.P. or 1.7 per cent. on Average of Test.

Engine and Transmission Load.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
MILL OILS.						
Sunday, May 13, 9.41 to 9.53 A. M.,	243.8	218.7	40	230.7	25.1	10.9
NEW OILS.						
Saturday, December 15, 12.40 to 12.52,	255.5	181.5	40	212.2	74.0	35.0

Results of Power Test.

Full Mill Load.

	I.H.P.
MILL OILS.— Average May 9, 10, 1906, ...	642.6
NEW OILS. — Average December 13, 14, 1906, (601.9 from which deduct machine correction of 5.1 H.P.), ...	596.8
Reduction, ...	45.8

or 7.1 per cent.

Engine and Transmission.

	I.H.P.
MILL OILS. — Average of May 13, 1906, ...	230.7
NEW OILS. — Average of December 15, 1906, (212.2 deduct 10.0 H.P. for new line of shafting not running on first test), ...	202.2
Reduction, ...	28.5

or 12.4 per cent.

Temperatures.

Rope Race Bearings.

(Average Readings of Six Bearings.)

	Bearing Tempt. Degrees Fahr.	Room Tempt. Degrees Fahr.	Heat due to Friction. Degrees Fahr.
Mill Oill,	142.5	97.5	45.0
New Oils,	113.0	91.3	21.7
Reduction of Frictional Heat,			23.3 °F.

or 51.8 per cent.

Line Shaft Bearings.

(Average Readings of Seven Bearings.)

	Bearing Tempt. Degrees Fahr.	Room Tempt. Degrees Fahr.	Heat Due to Friction. Degrees Fahr.
Mill Oils,	123.7	97.3	26.4
New Oils,	103.0	89.3	13.7
Reduction of Frictional Heat,			12.7 °F.

or 48.1 per cent.

Ring Spindle Temperatures.

(Average of Three Ring Spindles.)

	Spindle Base. Degrees Fahr.	Room. Degrees Fahr.	Heat Due to Friction. Degrees Fahr.
Mill Oils,	104.0	96.0	8.0
New Oils,	90.7	86.0	4.7
Reduction of Frictional Heat,			3.3° F.

or 41.2 per cent.

Engine Data.

	Revolutions.	Steam Pressure.	Vacuum.
Average First Test,	51.7	109	24.6
Average Second Test,	51.3	100	25.0

Mill Oils. **Temperature and Relative Humidity.**

1906.	Spinning No. 1.		Spinning No. 2.		Outside.	
	Temperature °F.	Relative Humidity. Per Cent.	Temperature °F	Relative Humidity. Per Cent.	Temperature °F	Relative Humidity. Per Cent.
Mill Oils.						
Wednesday, May 9,	95	51	99	60	101	50
Thursday, May 10,	97	47	101	60	99	48
Average . . .	96	49	100	60	100	49
New Oils.						
Thursday, Dec. 13,	82	52	78	40	76	46
Friday, Dec. 14,	81	47	78	39	77	49
Average . . .	81.5	49.5	78	40	76.5	48

Temperature was greatly against a reduction in power. The Relative Humidity effect would probably about average, though the Humidity in No. 2 Room shows a considerable increase for the first test over the outside condition, due to artificial means. This would act towards increasing the power for that one room as compared to a lower per cent. of Relative Humidity.

Summary of Results of Test.

Reduction on the Full Mill Load of, ... 45.8 H.P. or 7.1 per cent.
Reduction on the Transmission Load of, ... 28.5 H.P. or 12.4 per cent.
Reduction in Temperature of Rope Race Bearings, . 23.3 °F. or 51.8 per cent.
Reduction in Temperature of Line Shaft Bearings, . 12.7 °F. or 48.1 per cent.
Reduction in Temperature of Ring Spindle Bearings, 3.3 °F. or 41.2 per cent.

Test No. 14. Test Made at Owari, Japan.

POWER TEST IN A JAPANESE COTTON SPINNING MILL.

Engine—T. Musgrave and Son, Bolton, England. Cross Compound 18″ x 34″ 4 ft. stroke. 100 lbs. pressure. 70 R. P. M. Developing about 350 H.P.

Machinery Operated—Usual Machinery for preparing and spinning cotton yarns, and for the second test 100 native made looms were added.

Complete Test—6 days. 4 indicators. 1,040 indicator cards. 2 operators.

First Test.

Mill Oils. **Full Mill Load.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average per day.
Tuesday, October 16, . . .	357.0	334.0	80	342.7	23.0	6.7
Wednesday, October 17, . . .	351.0	327.0	160	340.2	24.0	7.1
Thursday, October 18, . . .	359.0	336.0	160	346.0	23.0	6.6
Friday, October 19, . . .	366.0	351.0	80	357.4	15.0	4.3
				346.6		

Difference of Averages 17.2 H.P. or 4.7 per cent. on Average of Test.

New Oils. **Second Test.**

	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, March 6, ...	340.0	323.0	80	332.5	17.0	5.1
Wednesday, March 7, ...	336.0	316.0	160	327.4	20.0	6.1
Thursday, March 8, ...	344.0	320.0	160	331.4	24.0	7.2
Friday, March 9, ... (9.30 to 12)	343.0	329.0	80	334.6	34.0	10.1
				331.5		

Difference of Averages 7.2 H.P. or 2.2 per cent. on Average of Test.

Load with the New Looms Off.

Friday, March 9, (7.30 to 9.45),	315.0	306.0	80	310.9

Influencing Conditions.

Counts spun. Heavier on second test which would be against the reduction shown.

Mill Oils. **Temperature and Relative Humidity.**

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
Tuesday, October 16,	86.0	58.0
Wednesday, October 17,	88.6	54.0
Thursday, October 18,	84.8	53.5
Friday, October 19,	84.0	54.0
Average,	86.0	55.0

New Oils.

Tuesday, March 6,	69.8	46.0
Wednesday, March 7,	73.2	49.0
Thursday, March 8,	69.4	46.0
Friday, March 9,	75.5	44.5
Average,	71.0	48.0

MILL OILS. — Average of October 16, 17, 18, 19, . . . 86.0 °Fahr. 55 per cent.
NEW OILS. — Average of March 6, 7, 8, 9, ... 71.0 °Fahr. 48 per cent.

The temperature was 15 degrees Fahr. lower during the second test which would be much against the reduction in power.

The Relative Humidity, however, was also lower which would be in favor of the reduction in power. These two influences would in all likelihood balance each other so that it may be considered that the atmospheric conditions were the same.

Machines in Operation.

	H.P.
Stoppages on first test,	5.4
Stoppages on second test,	7.3
Difference to be added to second test,	1.9
Extra Power for Weaving Department, second test,	19.8

The difference (17.9 H.P.) is to be deducted from the 2nd test.

Coal Consumption.

Average Consumption for Two Hours for Each Day of Test.

	Kwan.
MILL OILS. — October,	1,525
NEW OILS. — March,	1,395
Reduction,	130

or 8.5 per cent.

Production.

Average Production Per Day During Each Test.

	Kwan.
MILL OILS. — October,	724,725
NEW OILS. — March,	754,150
Increase,	29,425

or 4.1 per cent.

Results of Power Test.

	I.H.P.
MILL OILS. — Average of October 16, 17, 18, 19, ...	346.6
NEW OILS. — Average of March 6, 7, 8, 9, (331.5 deduct 17.9 H.P.) .	313.6
Reduction, ...	33.0
or 9.5 per cent.	

Summary.

This test produced the following result due to a change of lubricants:

Total H.P. of the mill was reduced . . . . . 33.0 H.P. or 9.5 per cent.

The coal consumption was reduced . . . . . 8.5 per cent.
while more machinery was in operation during the second test.

The production of the mill was increased . . . . . 4.1 per cent.
during the second test.

Test No. 15. Test made at Bombay, India.

POWER TEST ON A FLOUR MILL IN INDIA.

Engine — Yates and Thom., England. Cross Compound Condensing. Cylinders 18″ and 30″ x 4 ft. stroke. Steam Pressure 100 lbs. 55.5 R.P.M.

Machinery driven by this engine is that usually found in a 25-roll plant on the Symon System.

Auxiliary Engine — Compound Condensing by Marshall Sons & Co. Cylinders 13″ and 21″ x 2 ft. stroke. Steam pressure 100 lbs. 90 R.P.M.

Machinery — Wheat Dressing Machinery, fans and elevators.

Both engines run continuously from Monday, A. M. until Sunday, A. M.

Complete Test — 8 days. 4 indicators. 680 indicator cards. 3 operators.

First Test.

Mill Oils. **Load on Flour Milling Machinery.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, January 30, . . .	305.5	287.2	80	293.1	18.3	6.2
Wednesday, January 31, . . .	301.3	287.4	80	292.8	13.9	4.7
				293.0		

Difference of Averages 0.3 H.P. or 0.1 per cent. on Average of Test.

New Oils.

1907	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H .P.	Variation per cent. on average of day.
Tuesday, May 22, ...	283.0	252.0	80	271.8	31.0	11.4
Wednesday, May 23, ...	274.8	255.3	80	268.3	19.5	7.3
				270.0		

Difference of Averages 3.5 H.P. or 1.3 per cent. on Average of Test.

Mill Oils. **Wheat Cleaning Machinery.**

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, January 25, ...	74.7	58.1	80	65.2	16.6	25.6
Friday, January 26, ...	76.1	64.6	80	71.9	11.5	16.0
				68.5		

Difference of Averages 6.7 or 9.8 per cent. on Average of Test.

New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Monday, April 23, ...	70.4	54.3	80	66.4	16.1	24.2
Tuesday, April 24, ...	69.9	65.2	40	67.3	4.7	7.0
				66.8		

Difference of Averages 0.9 H.P. or 0.1 per cent. on Average of Test.

Wheat Dressing Machinery Running Light Except for One Hoist Delivering Grain to Silo.

Mill Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Thursday, January 25, ...	62.7	55.3	40	58.9	7.4	12.6
NEW OILS.						
Thursday, April 22, ...	52.7	48.7	40	50.6	4.0	8.0

Power Reductions.

Flour Mill.

	I.P.H.
MILL OILS. — January 30, 31, 1906, ...	293.0
NEW OILS. — May 22, 23, 1907, ...	270.0
Reduction, ...	23.0

or 7.9 per cent.

Wheat Dressing, Full Load.

	I.H.P.
MILL OILS. — January 25, 26, 1906, ...	68.5
NEW OILS. — April 23, 24, 1906, ...	66.8
Reduction, ...	1.7

or 2.5 per cent.

Wheat Dressing, Friction Load.

	I.H.P.
MILL OILS. — January 25, 1906, ...	58.9
NEW OILS. — April 22, 1906, ...	50.6
Reduction, ...	8.3

or 14.1 per cent.

Power Test on the Entire Mill.

	I.H.P.
MILL OILS. — Both Engines, ...	364.7
NEW OILS. — Both Engines, ...	336.8
Reduction, ...	27.9

or 7.7 per cent.

Temperature Tests.

Tests on Nine Bearings in Mill.

	Bearing.	Room.	Frictional Heat.	Difference Degrees Fahr.	Per cent. on Total Frictional Heat.
Mill Oils	123	85	38		
New Oils	113	87	26		
				12	31.6

Temperatures of Line Shaft Bearings in Wheat Dressing Mill.

	Bearing.	Room.	Frictional Heat.	Difference Degrees Fahr.	Per cent. on Total Frictional Heat.
Bearing A					
Mill Oils	131	80	51		
New Oils	124	83	41		
				10	19.6
Bearing B					
Mill Oils	114	80	34		
New Oils	109	83	26		
				8	23.5
Bearing C					
Mill Oils.	115	81	34		
New Oils	113	83	30		
				4	11.8
Bearing D					
Mill Oils	109	82	27		
New Oils	101	83	18		
				9	33.3

Temperature of Line Shaft Bearings in Flour Mill.

	Bearing.	Room.	Frictional Heat.	Difference Degrees Fahr.	Per cent on Total Frictional Heat.
Bearing E					
Mill Oils	130	83	47		
New Oils	104	92	12		
				35	74.4
Bearing F					
Mill Oils	109	83	26		
New Oils	113	92	21		
				5	19.2

Temperature of Three Flour Roll Bearings.

	Bearing.	Room.	Frictional Heat.	Difference Degrees Fahr.	Per cent. on Total Frictional Heat.
Mill Oils	125	92	33		
New Oils	122	90	32	1	3.3
Mill Oils	137	92	45		
New Oils	120	90	30	15	33.3
Mill Oils	136	92	44		
New Oils	117	90	27	17	38.6

Summary.

Power Reduction on complete mill . . . . . 27.9 H.P. or 7.7 per cent.
Reductions in Temperature on all bearings tested from 1 to 35 °F.
or in per cent. of the total heat due to friction
from . . . . . 3.3 per cent. to 74.0 per cent.

The grain operated upon was the same in both tests, viz., Pure Indian Wheat, but there was a 2 per cent. greater production favoring the reduction in power; this is, however, offset by the climatic conditions which were very much against the reduction, the balance of effect being probably a decreased power.

Test No. 16. Test made at Sittingbourne, Kent, England.

POWER TEST IN A PAPER MILL.

Engine — Pollit and Wigzell. Tandem Compound. Corliss Valves on H.P. Slide Valves on L.P. Revolutions 76 per minute. Steam Pressure 120 lbs. Superheated 100 °F.

Machinery Operated — Line and Counter Shafting. 6 Pouchers. 4 Beaters. 4 Refiners. 3 Centrifugal Pumps. 6 Circulating Pumps. Saw, Elevator, Crane.

Complete Test — 8 days. 4 indicators. 1,474 indicator cards. 7 operators.

Paper Made — First Test, October 18 to 21, 1904. 182 tons, 2 cwt.
Second Test, March 21 to 24, 1905, 192 tons, 10 cwt.

Mill Oils. **First Test.**

1904.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, October 18 . . .	573.5	441.3	160	538.4	132.2	24.6
Wednesday, October 19 . . .	573.8	473.0	160	527.9	100.8	19.1
Thursday, October 20 . . .	605.6	409.2	160	531.1	196.4	36.9
Friday, October 21 . . .	615.2	431.1	160	558.8	184.1	32.9
				539.1		

Difference of Averages 31.8 H.P. or 5.9 per cent. on Average of Test.

New Oils. **Second Test.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, March 21	544.2	457.9	160	514.3	86.4	16.7
Wednesday, March 22	571.8	365.3	160	514.8	206.5	40.1
Thursday, March 23	526.8	337.6	160	472.9	189.2	40.0
Friday, March 24	545.2	386.7	160	511.3	158.5	31.0
				503.3		

Difference of Averages 41.9 H.P. or 8.3 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS and Greases. — Average of October 18, 19, 20, 21, 1904, . .	539.1
NEW OILS. — Average of March 21, 22, 23, 24, 1905 (deduct Machine Correction of 14.2 H.P.).	489.1
Reduction, ...	50.0

or 9.3 per cent.

Basis per Ton of Paper Produced.

	I.H.P.
MILL OILS and Greases. — Power per ton of paper produced, ...	2.96
NEW OILS. — Power per ton of paper produced, ...	2.48
Reduction, ...	0.48

or 1.62 per cent.

The power of this mill with the No. 8 Refiners off, pumping back and charging which make the great variation.

Mill Oils.

1904.	Maximum H. P.	Minimum H. P.	Number of Cards	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, October 18 . . .	472.0	441.3	16	470.2	3.07	6.5
Wednesday, October 19 . . .	No. 8 Refiners on all during test.					
Thursday, October 20 . . .	486.1	409.2	44	462.2	76.9	16.5
Friday, October 21 . . .	508.1	431.1	28	463.7	77.0	16.6
				465.4		

Difference of Averages 8 H.P. or 1.7 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Tuesday, March 21	No. 8 Refiners on all during test.					
Wednesday, March 22	432.5	400.9	32	401.1	31.6	7.8
Thursday, March 23	471.7	337.6	66	382.8	134.1	35.0
Friday, March 24	388.0	386.7	8	387.3	1.3	.3
				390.4		

Difference of Averages 13.8 H.P. or 3.5 per cent. on Average of Test.

Result.

	I.H.P.
MILL OILS.—Average of October 18, 20, 21, 1904. (Load without No. 8 Refiners), ...	465.4
NEW OILS.—Average of March 22, 23, 24, 1905. (Load without No. 8 Refiners), ...	390.4
Reduction, ...	75.0

or 16.2 per cent,

Test No. 17. Test made at Niederschlemma, Germany.

POWER TEST ON A GERMAN PAPER MILL.

Engine—Triple Tandem Compound. Condensation. Made by the Crimmitschauer Maschinenfabrik in 1897. Cylinders: No. 1.—460 m/m. No. 2,—800 m/m. No. 3,—1,050 m/m. Stroke 1,000 m/m. Pressure 12 Atm. Superheating from 260 to 320 °C. Normal I. P. S. 500.

Machinery Operated—7 Schleifapparate mit je 5 Pressen. 4 Vorsortirer mit Schüttelsieben. 4 Raffineure. 4 Feinsortirer. 4 Rundsiebpappmaschinen. 1 Wasserpumpe. 1 Elektromotor.

Complete Test—6 days. 6 indicators. 1,800 indicator cards. 3 operators.

First Test.

Mill Oils. **Full Mill Load.**

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Monday, February 20 . . .	523.8	469.2	300	501.1	54.6	10.9
Tuesday, February 21 . . .	544.5	484.6	300	509.0	59.9	11.8
Wednesday, February 22 . . .	551.6	498.6	300	523.8	53.0	10.1
				511.37		

Difference of Averages 22.7 P.S. or 4.4 per cent. on Average of Test.

New Oils. **Second Test.**

1905.	Maximum P. S.	Minimum P. S.	Number of Cards.	Average P. S.	Variation in P. S.	Variation per cent. on average of day.
Wednesday, May 23	502.2	413.1	300	469.6	89.1	19.0
Thursday, May 24	515.8	471.0	300	490.8	44.8	9.1
Friday, May 25	507.4	446.1	300	484.9	61.3	12.6
				482.43		

Difference of Averages 21.2 P.S. or 4.4 per cent. on Average of Test.

Result.

	I.P.S.
MILL OILS. — Average of February 20, 21, 22, 1905,	511.37
NEW OILS. — Average of May 23, 24, 25, 1905,	482.43
Reduction,	28.94

or 5.6 per cent.

P.S. Per Ctr. Holzstoff Produced.

	I.P.S.	Ctr.	P.S. Ctr.
Mill Oils,	511.37	567	= 0.90
New Oils,	482.43	564	= 0.85
Reduction,			0.05

or 8.6 per cent.

Test No. 18. Test Made at Sunderland, England.

SECTION OF BRASS WORKING SHOP TEST.

Motor — British Westinghouse. 3 Phase. 15 H.P. 220 Volts at 45 amp. per terminal. Full load speed 560 R. P. M.

Machinery Operated — Lathes, Drilling Machines, Emery Wheels, Grind Stone and all machines for a first class Brass Fitting Shop.

The current used was measured by the number of revolutions of the disk inside the watt meter, which, from information obtained from the makers, the British Thompson, Houston Co. makes twenty-five revolutions per board of trade unit passed. The disk revolutions give, therefore, the actual ratio of current used under the two conditions of working.

Note—This is the second series of lubricating tests made upon this shop. The first series showing such great reductions due to the fact that the shop oil had left a very undesirable deposit, that it was considered fair to all parties to make another trial giving the shop oil the advantage of the bearings that has been cleaned by the new oil. Assuming that the shop oil would again put the bearings in the same state as when first found (which proved to be the case) sufficient time was allowed for the new oil to again clean away these deposits before the comparative test was made.

First Test.

(Second Series.)

Shop Oils. All Machines running light.

1906.	Time.	Revolutions Per Minute.		Amps.	Meter Disk Revolutions for Twenty Minutes.
		Motor.	Shaft.		
Thursday, January 25	1.02–1.20	571.0	115.9	34.0	177.0
Thursday, January 25	5.06–5.24	581.3	118.0	33.1	166.0
Friday, January 26	1.04–1.22	579.0	118.4	32.6	164.1
Friday, January 26	5.02–5.20	577.3	117.6	35.1	176.7
Average		577.2	177.5	33.7	170.9

New Oils.

1906.	Time.	Revolutions Per Minute.		Amps.	Meter Disk Revolutions for Twenty Minutes.
		Motor.	Shaft.		
Tuesday, February 13 . . .	1.02–1.20	592.1	120.1	24.8	127.5
Tuesday, February 13 . . .	5.04–5.22	593.6	120.4	26.5	135.2
Wednesday, February 14 . . .	1.02–1.20	584.2	119.4	24.6	126.5
Wednesday, February 14 . . .	5.02–5.20	591.8	120.2	22.4	122.7
Average		590.4	120.0	24.6	128.0

Second Test.

(Second Series.)

All belts on loose pulleys. Motor and shafting only.

1906.	Time.	Revolutions Per Minute.		Amps.	Meter Disk Revolutions for Twenty Minutes.
		Motor.	Shaft.		
Shop Oils.					
Thursday, January 25	8.31–8.49	611.5	125.2	10.0	42.8
Thursday, January 25	1.28–1.46	597.9	122.2	11.6	46.1
Friday, January 26	8.30–8.48	616.9	124.4	10.0	41.2
Friday, January 26	1.28–8.48	601.2	125.0	11.8	47.1
Average		606.9	124.2	10.8	44.3
New Oils.					
Tuesday, February 13 . . .	8.32–8.50	620.7	126.5	9.0	38.7
Tuesday, February 13 . . .	1.27–1.45	612.3	125.7	9.0	37.2
Wednesday, February 14 . . .	8.32–8.50	613.3	126.3	9.3	38.5
Wednesday, February 14 . . .	1.25–1.43	603.8	124.9	9.8	38.3
Average		612.5	125.8	9.3	38.2

Result.

Full Load with all Machines Running Light.

	Meter. Disk Revs.	Units Used.
Shop Oils.—Average of four runs of 20 minutes each, : . . .	168.5	6.740
New Oils.—Average of four runs of 20 minutes each, . . .	128.0	5.120
Reduction equals 24.0 per cent. of power or	40.5	1.620

while the motor and line shaft were running 2 per cent. higher speed.

Motor and Shafting Load.

	Meter. Disk Revs.	Units Used.
Shop Oils.—Average of four runs of 20 minutes each, ...	44.3	1.772
New Oils.—Average of four runs ot 20 minutes each, ...	38.2	1.528
Reduction equals 13.8 per cent. of power or . . .	6.1	0.244

Temperature of Two Shaft Bearings.

	Degrees Fahr.
Shop Oils.—Average of 32 half hour readings. Temperature of bearings above temperature of surrounding atmosphere	18.0
New Oils.	9.7
Reduction, ...	8.3

or 46.1 per cent.

Temperature and Relative Humidity.

Readings Every Half Hour.

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
SHOP OILS.— January 25, 26, 1906. Average, . .	56.1	75.5
NEW OILS. — February 13, 14, 1906. Average, . .	50.5	73.5

Both Temperature and Relative Humidity are against a Reduction in Power.

Shop Readings of Units.

Total number of units for two weeks before the change was made in lubrication, ...	1,280
Total number of units for two weeks after the New Oils were put in use .	920
Reduction, ...	360

or 28.1 per cent.

At a price of 1⅛ d. per unit this saving for two weeks represented £1.13.9 ($8.16). The cost for oil was practically the same.

Test No. 19. Test made at Oldham, England.

ENGINEERING (Machine) SHOP TEST.

Engine — Willans and Robinson. Two line Compound. 145 I.H.P. at 350 R.P.M. Pressure 100 lbs.

Machinery Operated — Transmission, Planing Machines, Lathes, Drills, Milling, Grinding, Turning and Polishing Machines.

Complete Test — 4 days. 320 indicator cards. 4 operators. Engine, Shafting, and all Machines running light.

Shop Oils. **First Test.**

1905	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, June 26, ...	138.66	136.44	40	137.40	2.22	1.6
Thursday, June 27, ...	139.23	136.92	40	138.17	2.31	1.7
				137.78		

Difference of Averages .77 H.P. or 0.6 per cent. on Average of Test.

Mill Oils. **Second Test.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, August 16, . .	116.02	114.30	40	115.23	1.72	1.5
Thursday, August 17, . . .	118.47	114.48	40	116.80	3.99	3.4
				116.01		

Difference of Averages 1.57 H.P. or 1.4 per cent. on Average of Test.

Shop Oils. **Engine and Transmission.**

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, June 26, ...	76.31	74.42	40	76.32	1.89	2.5
Thursday, June 27, ...	75.45	72.46	50	73.41	2.99	4.1
				74.86		

Difference of Averages 2.91 H.P. or 3.9 per cent. on Average of Test.

New Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Wednesday, August 16, . . .	69.53	68.01	40	68.80	1.52	2.2
Thursday, August 17, . . .	68.20	66.52	40	67.32	1.68	2.5
				68.06		

Difference of Averages 1.48 H.P. or 2.2 on Average of Test.

Result of Test.

Engine, Shafting and Machines (Running Light).

	I.H.P.
SHOP OILS.— Average of June 28, 29, 1905,	137.8
NEW OILS. — Average of August 16, 17, 1905,	116.0
Reduction,	21.8

or 15. 8 per cent.

Engine and Transmisson.

	I.H.P.
SHOP OILS.— Average of June 28, 29, 1905,	74 9
NEW OILS. — Average of August 16, 17, 1905,	68.1
Reduction,	6.8

or 9.1 per cent.

Reduction in Cost of Lubrication, 40 per cent.

Test No. 20. Test Make at Sunderland, England.

WOOD WORKING SHOP TEST.

(Joiner's Shop.)

Engine— Galloways, Manchester. Diagonal Compound, non-condensing. 12″ and 20″ x 30″ stroke. Steam Pressure 90 lbs. 88 R.P M. Developing about 80 I.H.P. Belt drive to counter shaft.

Machinery Operated— Line and counter shaft. High speed circular saws. Planing, moulding, mortising and tenoning machines. Lathes, drills, etc., as used in a first class Joiner's Shop.
The line shafts were all under the floor and driven up to the machines on the next floor.

Complete Test — 2 days. 4 indicators. 320 indicator cards. 3 operators.

First Test.

Engine Transmission and all Machines Running Light.

Shop Oils.

1905.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Saturday, December 2, ...	93.2	70.0	80	84.0	23.2	27.6
Engine and Transmission Saturday, December 2, . . .	33.5	30.5	80	31.6	3.0	9.5

Second Test.

New Oils.

1906.	Maximum H. P.	Minimum H. P.	Number of Cards.	Average H. P.	Variation in H. P.	Variation per cent. on average of day.
Saturday, January 20, ...	76.7	54.5	80	65.3	22.2	34.0
Engine and Transmission. Saturday, January 20, ...	27.0	23.9	80	25.4	3.1	12.2

Result.

Full Load.

		I.H.P.
SHOP OILS.— December 2, 1905.	Engine 87.7 R.P.M., ...	84.0
NEW OILS. — January 20, 1906.	Engine 87.8 R.P.M., ...	65.3
Reduction, ...		18.7

or 22.3 per cent.

Engine and Transmission Load.

		I.H.P.
SHOP OILS.— December 2, 1905.	Engine 79.75 R.P.M., ...	31.6
NEW OILS.— January 20, 1906.	Engine 79.2 R.P.M., ...	25.4
Reduction, ...		6.2

or 19.6 per cent.

Temperature.

	Degrees Fahr.
Under the old conditions of working with previous Grease (which was used for lubricating the line shaft) the average temperature of six bearings on line shaft above the temperature of the surrounding atmosphere was,	41.7
Under the New Oil the average temperature of the same six bearings above the surrounding room temperature (same thermometers and observers) was,	15.2
Reduction,	31.9

or 67.7 per cent.

Temperatures and Relative Humidity.

Averages from Half Hour Readings During Test.

	Temperature Degrees Fahr.	Relative Humidity Per Cent.
SHOP OILS.— Saturday, December 2, 1905,	54.6	48.2
NEW OILS. — Saturday, January 20, 1906,	47.9	71.0

Temperature of the atmosphere against a reduction in power.

Relative Humidity in favor of a reduction of power.

(Humidity effects a test of this kind the opposite to the effect upon a Textile Mill.)

During the first test upon the Shop Oil December 2, 1905, it was found impossible to run all the machinery light as the load was too great for the engine.

During the second test the engine could easily carry the load of all the machines running light.

The same number of machines are in operation for the official figures for each test given above.

The Secretary announced that through the courtesy of Mr. HAROLD C. HANSEN of New York, a friend of the management of the Boston Hippodrome, the courtesies of the Hippodrome were extended for this evening to members and guests of the Association with ladies.

REPORT OF COMMITTEE ON RESOLUTIONS.

The PRESIDENT. The Committee on Resolutions are ready to report. Mr. LYALL, the secretary of the committee, will read the report.

Mr. WILLIAM F. LYALL. *Mr. President*, Mr. MACCOLL, the chairman of the committee, was unable to be present at this time and has requested me to read the report.

The Committee on Resolutions recommends the adoption of the following resolutions:

Gin Compressing.

Resolved, that this Association cordially approves of the efforts being made by southern growers to introduce the system of gin compressing. It recognizes that the present American bale is not a creditable package and that gin compressing, besides producing a bale properly covered and of sufficient density, will effect great economy in freight, in cost of baling aed in time of transportation from the grower to the spinner.

Semi-Annual Cotton Stock Statistics.

Whereas, the Bureau of the Census has in recent years published statistics of cotton stocks in the hands of American manufacturers at September 1 and,

Whereas, the International European Federation has supplied similar information regarding European stocks semi-annually namely, at March 1 and September 1; therefore

Be it resolved, that the director of the census be respectfully requested to supplement the semi-annual European statistics of March 1 by reporting the American stocks at the same date.

National Forest Reserves.

Whereas, denudation on the steep slopes of the White Mountains is now progressing with unprecedented rapidity, followed by fire that consumes the soil, setting back the return of a useful forest growth for a long period, and in places forever; and,

Whereas, erosion in the southern Appalachian Mountains is similar in its evil effect, and in both regions the forests are far more valuable for the protection of waterflow than they can be for immediate consumption, especially under the present wasteful methods of lumbering; therefore,

Be it resolved, by The National Association of Cotton Manufacturers, that we view with dissatisfaction the delay in the House of Representatives in forwarding the bill for national forest reserves in the White Mountains and southern Appalachian Mountains, and we respectfully request the representatives from our several districts to use their utmost endeavors to secure the passage of this bill at this session of Congress; and be it further

Resolved, that the president and secretary of this Association are requested to continue such efforts in behalf of this bill as in their judgment is wise.

Resolved, that the thanks of the Association are hereby tendered to the Massachusetts Institute of Technology for the use of its hall and committee rooms, and to the following gentlemen for the addresses and papers with which they have favored us at this meeting: ARTHUR H. NOYES, Ph. D., His Honor EBEN S. DRAPER, Hon. JAMES LOGAN, WILLIAM B. WEEDEN, F. G. SCHELL, WILLIAM HOWARTH, ROBERT J. HOGUET, JOHN A. NASMITH, E. G. BAILEY, HENRY CLEWS, LL.D., Rev. FREDERICK W. HAMILTON, D. D., and Hon. HARVEY N. SHEPARD.

Respectfully submitted,

JAMES R. MACCOLL, *Chairman.*
WILLIAM L. LYALL, *Secretary.*

The PRESIDENT. Gentlemen, what is your pleasure as to

these resolutions? Do you wish to vote upon them separately or as a whole?

Mr. JAMES P. TOLMAN. I move they be adopted as a whole, sir.

The motion was seconded and adopted.

The PRESIDENT. The resolutions are adopted unanimously. Is there any further business before this session? If not, I declare this meeting adjourned until this afternoon.

FOURTH SESSION.

FRIDAY AFTERNOON, APRIL 18, 1908.

The Association met in Huntington Hall at 2 P. M., President HARTSHORNE in the chair.

The PRESIDENT. The meeting will please come to order. The first paper this afternoon is on "The Construction and Ventilation of a Weave Shed," by Mr. SAMUEL M. GREEN, a mill engineer of note, and an associate member of this Association. I take pleasure in introducing Mr. SAMUEL M. GREEN.

THE CONSTRUCTION AND VENTILATION OF A WEAVE SHED.

SAMUEL M. GREEN, Holyoke, Mass.

In the fall of 1904, the Farr Alpaca Company, of Holyoke, Mass., commissioned the writer to build a weave shed for them, and specifically stated that they wished the difficulties experienced with the weave shed they were then operating eliminated as far as possible in the new design.

Mr. W. W. STEARNS, the superintendent of the manufacturing departments of this company, had for many years contended with the difficulties experienced in the old type of weave shed and had copious notes and suggestions in regard to betterments.

The first weave shed, with sawtooth skylight, for this company, was erected in 1874. This shed had a rather low roof and constant difficulty was experienced with leakage and condensation. It has also proved very difficult to properly ventilate.

It was determined to find out if possible the latest practice in weave shed construction, and Mr. STEARNS visited a large number of the recently constructed weave sheds in the southeastern part of Massachusetts and Rhode Island. He was surprised to find that apparently little progress had been made in the elimination of the difficulties which he had experienced with the old type. He found that a great many sheds were being heated and ventilated by a fan system, but these systems had been so installed that in winter portions of the room were too cold or too hot.

The condensation from the glass and roof was a great annoyance in about every shed visited. We therefore determined to

see what could be done to remedy these difficulties and this paper is descriptive of the weave shed that was constructed, and as the desired results have been accomplished, it may be of interest to the members of this Association.

I will not go into a discussion of the reasons for the use of what is known as the sawtooth construction of skylights for weave sheds because everyone familiar with this class of building knows it to be the only practical way of properly lighting such a building. The advantages of the sawtooth form of skylight over the ordinary hipped skylight are north light and elimination of the direct rays of the sun.

1. Practically all of the troubles of the sawtooth method of skylight construction are caused by severe winter weather conditions and can be classed under two heads, *i. e.*, leakage caused by severe snow, ice or sleet storms, and inside condensation caused by low outside temperature.

When snow and ice accumulate on a sawtooth roof, they melt near the peak of the roof and run down towards the gutter. As the water runs into the shadow caused by the peak of the next sawtooth, it wlll freeze on the lower portion of the roof and in the gutters. This alternate freezing and thawing causes the water to back up under flashings, and it is therefore necessary to make them absolutely tight.

2. Figure 1 is a detail of gutter, glass, stile and ridge construction, as adopted for this weave shed. It will be noted that the toe of the truss is supported by an I-beam column and that the gutter is supported by light cross beams. These beams are set at different heights in the length of the gutter, so that proper pitch is obtained from the high point of the gutter to the point where the water is taken down.

The curb or bottom part of the skylight sash is made of 4″ Michigan pine, bevelled at a sharp angle at its top to permit the water of condensation to readily run off the curb, and it is also grooved at the lower part of this bevel to form a drip edge, so that all condensation on the glass will drip into a small copper gutter which is carried the whole length of this sill. This copper

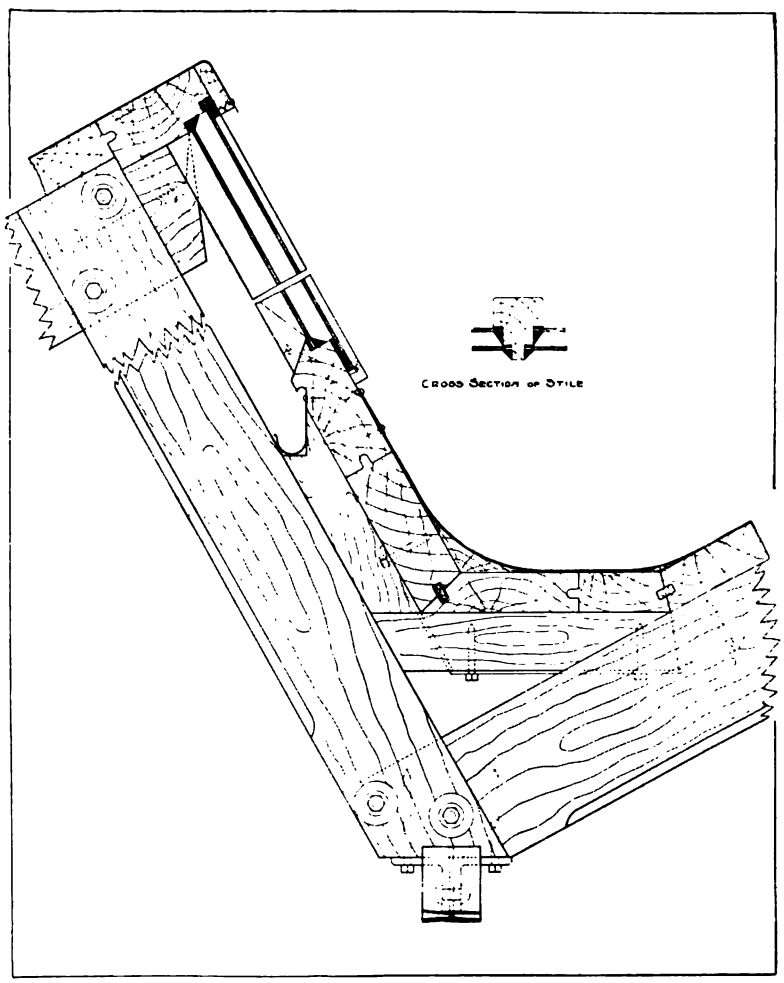


FIGURE 1.

gutter is connected by means of small lead pipes to the regular roof downtakes.

3. The gutter proper is made as follows:

The corners formed between the bottom of the gutter and the curb on one side, and the gutter and the flat roof on the other, are filled with a fillet of wood of curved shape. Then sheet

asbestos 1-16″ thick is laid, extending up to within 3″ of the glass on one side, and 2′-0″ on the flat roof on the other side. On this asbestos is then laid galvanized iron of about No. 24 gauge, extending to the same height as the asbestos paper. This galvanized iron is nailed to the roof. The object of the galvanized iron is to make a gutter firm and smooth to walk upon, and cover any imperfections in the plank. This is especially necessary when the plank shrink, as otherwise anyone walking in the gutter would, in time, puncture the roof, either through the cracks between the planks caused by shrinkage, or through imperfections in the plank. The asbestos paper is first laid underneath this galvanized iron, in order to prevent the moist air from the room below finding its way through the cracks in the plank, striking the galvanized iron and condensing and dripping back into the room below. After the gutter is thus prepared, it is ready to receive the regular five-ply or pitch roofing. In the gutter itself six-ply is used, to strengthen the roof at this point. The roofing material itself should be thoroughly nailed and mopped. Immediately underneath the lower end of the glass there is a flashing of galvanized iron, which is cut into the sill of the skylight by a specially prepared tool. The wood is simply opened by a thin wedge and the galvanized iron driven into this opening. This galvanized iron extends down and over the roofing material and is thoroughly nailed throughout its entire length. It is then mopped with pitch to make it watertight.

4. To determine the best method to use for the stiles of the skylight, I placed in the old weave shed a system of metal bars of well known make. This was during the winter. It was found that the drainage from this metal bar to the outside froze and the water of condensation was delivered into the room instead of outside the building. In severe weather, moisture would collect on this bar and icicles would form on the lower part of it. I therefore discarded the metal frame.

5. The stiles or bars of the skylight were made of white pine, firmly fastened to the curb and ridge with brass screws. Both

the curbing and stiles were kiln dried and were shellaced before delivery on the roof.

6. The glazing is double; the inside light is of ¼ inch factory ribbed glass, and the outside of plain double-thick glass. The outside glass is held from slipping downwards by means of brass screws. Both lights were thoroughly bedded in putty and the outside light was properly drawn. The putty used contained 33⅓ per cent. of white lead.

FIGURE 2.

7. As is shown in Figure 2, the gutters are drained at various points throughout their length. A copper bowl is set into the roof and this bowl is set down into the plank so that there will be no accumulation of water immediately around it. From this copper bowl a lead pipe is connected to a down-take column, which in this instance, is made of channel iron. The down-take pipe passes within this column to the drainage pipes in the basement. The roof bowl and down-take are covered by non-con-

ducting material. A shield of galvanized iron is placed over the down-take pipe where it passes through the channel iron column. This shield is fastened to the down-take column to protect the copper down-take from injury. One of these columns is shown in the forepart of Figure 2.

8. The roofing material used upon this weave shed was five-ply asphalt, and especial care was taken in nailing the felt to the roof. The roof has now passed through three (3) winters and does not show as yet any signs of deterioration. If it lasts through another winter I shall consider it good for the purpose.

FIGURE 3.

9. The supporting work of the roof and floor is of steel, Figures 2 and 3. The columns are I-beams, these being used because they were narrow and allowed the looms to be set close together. The columns are continuous from the toe of the sky-light to the foundation in the basement, and are bolted to these foundations. The main floor is supported upon I-beam stringers

upon which, at right angles, are bolted wooden timbers. To the top of these wooden timbers a four inch matched plank is spiked, and on the top of this is a ⅞ inch hard wood floor.

10. It will be noted from Figure 2 that the looms are driven from overhead counters and shafting. A great many weave sheds are driven from shafting in the basement, but experience seems to have proven that with the belts below there is a great deal of loss of time of loom fixers going into the basement, in order to throw the belts on. The convenience of handling the belts with the overhead drive, in the opinion of Mr. STEARNS, more than offsets the inconvenience and dirt occasioned by having the drive overhead.

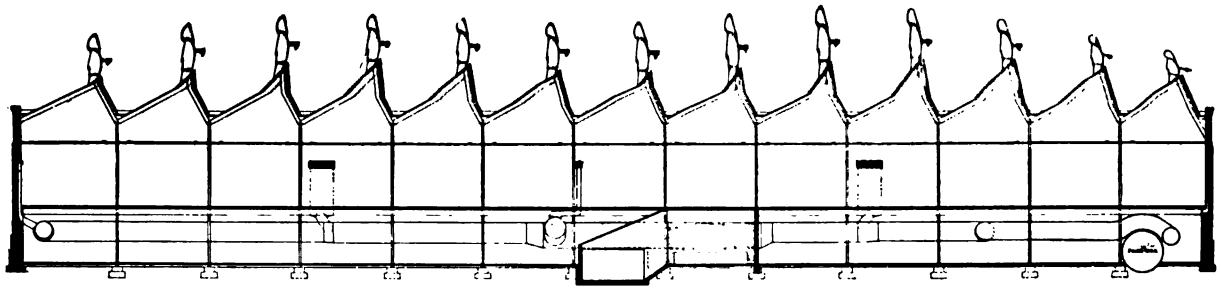
The method of drive is by electric motors, belted to the main line shafts, these line shafts being belted to various counters and from the counters direct to the looms.

VENTILATING AND HEATING.

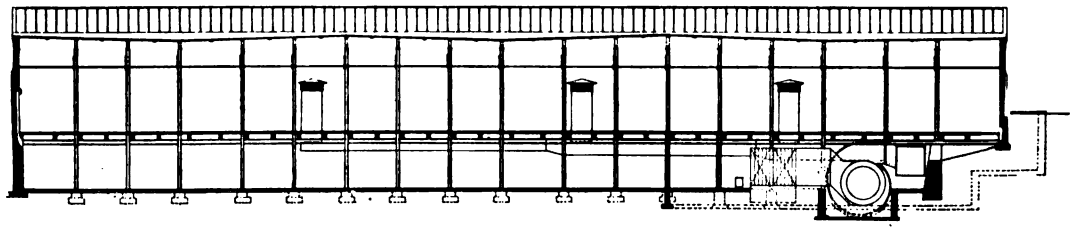
After a thorough investigation of the methods in vogue in various weave sheds throughout the country, it was decided to heat this shed by direct radiation, and to accomplish this result, steam pipes were placed around the walls of the building, near the floor, and also run lengthwise of the building, underneath the skylights. One-third of the amount of pipe in this building is at the roof, and two-thirds near the floor line.

The direct system of radiation was adopted because of the fact that it is more economical to operate.

For the ventilating, cooling and humidifying, fans were placed in the basement. There are two (2) steel plate blowers, having wheels ninety inches in diameter and forty-eight inch face. They are arranged as shown in Figures 4 and 5, and they can either draw air from outside, from the basement, or from both sources. These fans are each driven by a 25 horse power motor, and they run at 150 revolutions per minute. The builders' rating for each of these fans, at this speed, is about 48,000 cubic feet of air per minute. Each of the fans, when running at its rated speed, requires 20 horse power to operate it.



CROSS SECTION



LONGITUDINAL SECTION

FIGURE 4—WEAVE SHED, FARR ALPACA CO., HOLYOKE, MASS.

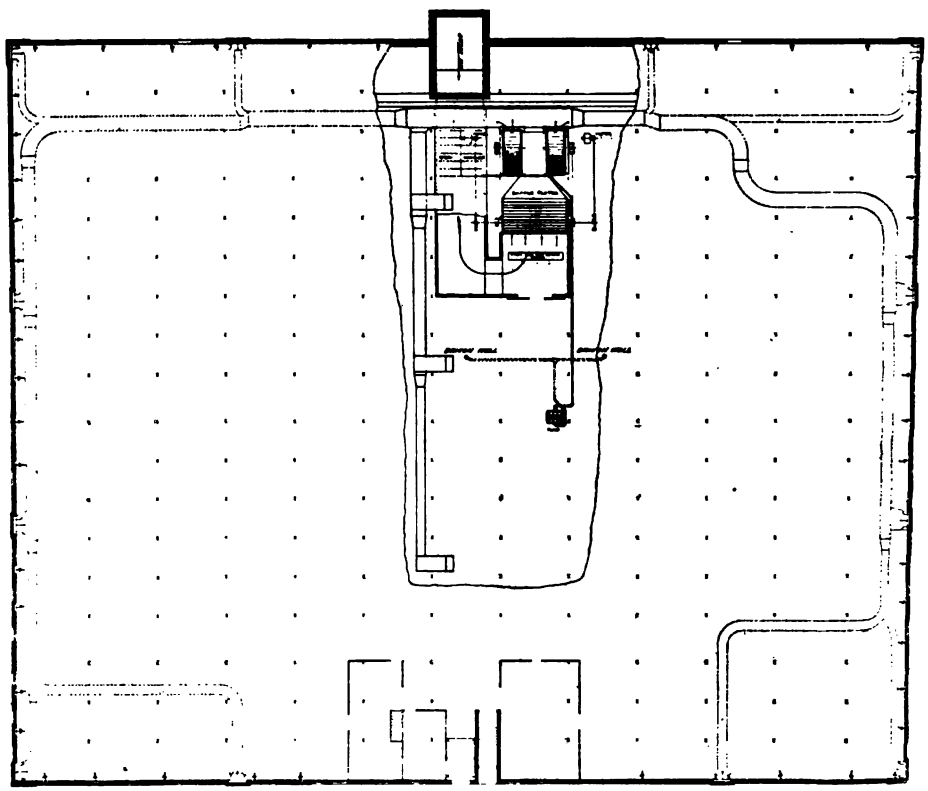


FIGURE 5—WEAVE SHED, FARR ALPACA CO., HOLYOKE, MASS.

The air is drawn from outside or from the basement, or from both sources at the same time, as shown by Figures 4 and 5.

For cooling and humidifying the air in the summer there is a system of spray nozzles placed in the conduit through which the air from outside passes to the fans.

These spray nozzles are of special design and deliver the water in an exceedingly fine spray into the air current. There are forty-eight of these nozzles and they require thirty gallons of water per minute, under about forty pounds pressure. The water to supply them is pumped from the ground by a triplex power pump, requiring about 3½ horse power to operate it.

The temperature of the water from these wells always remains at 54 degrees Fahrenheit. After the air passes through this fine spray of water it encounters baffle plates which remove the entrained water, and the air then passes on to the fans, and is carried by galvanized iron piping to various sections of the basement, and from there passes up into the weave room above through pipes in the walls, and is delivered into the weave room at about eight (8) feet above the floor. Deflectors have been arranged on these outlets so that the air can be guided in the proper direction, as it was found that if this current of air strikes the weavers they feel chilly. It is therefore guided just over their heads.

On each sawtooth there are provided four (4) sixteen inch ventilators. Roof ventilators have been a constant source of annoyance, owing to the fact that they condense the moisture from the outgoing air, which drips into the room below. To obviate this difficulty these ventilators were designed as is shown by Figure 6. The walls of both the stationary and revolving parts are made double and the space between is filled with non-conducting material. In order to tightly close the ventilators, to prevent condensation in winter, a damper was designed as is shown in Figures 3 and 6. This damper shuts against soft packing and has proved satisfactory. A slight amount of condensation, however, has occurred even with this tight-closing damper, and this is cared for by a metal trough, as is shown in Figure 6, into which this condensation drips. It alternately collects in this trough and then re-evaporates.

Both fans are operated at their maximum capacity during the summer. For humidifying and ventilating in winter, one fan is operated, drawing part of its air from the basement and part from out of doors. The air is humidified by passing over an iron trough in which water is boiled. The steam arising from this boiling water accomplishes the proper humidification.

There are a large number of openings from the weave room into the basement, at the floor line. These openings are protected by automatic dampers, so that in case of fire they will

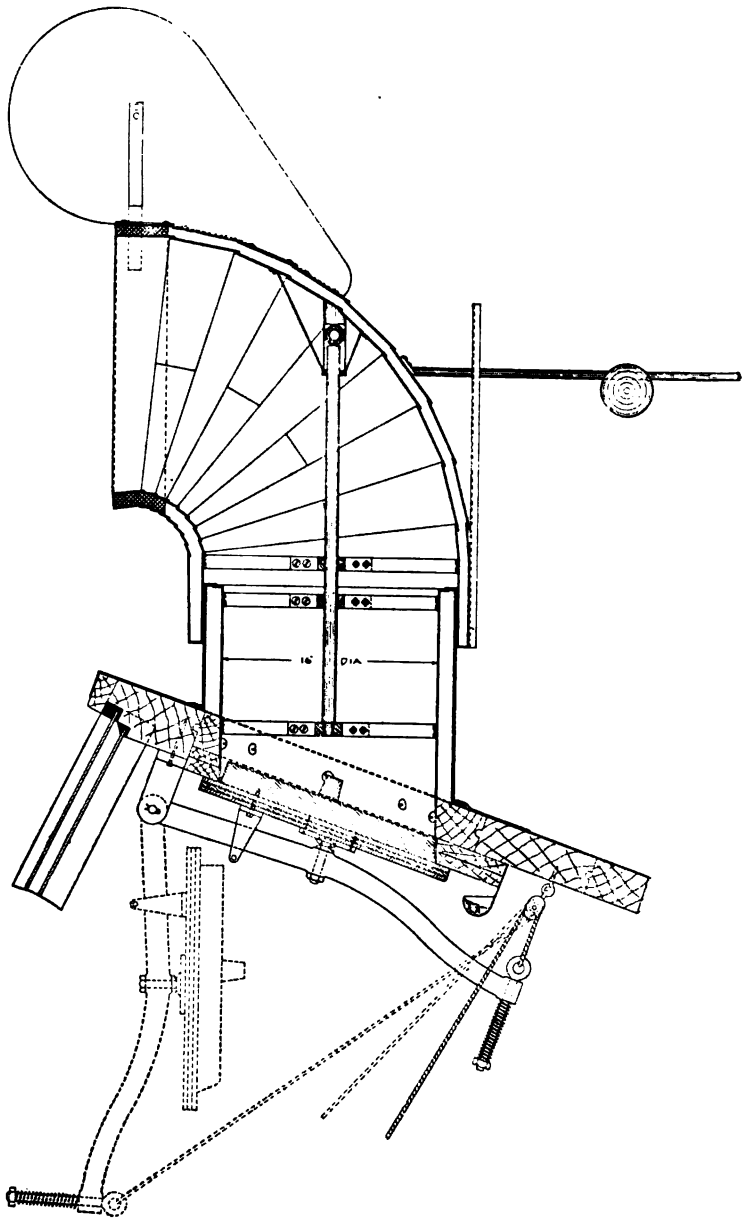


FIGURE 6.

TABLE OF TESTS SHOWING THE DEGREES OF TEMPERATURE AND HUMIDITY IN "B" WEAVE SHED OF FARR ALPACA COMPANY, HOLYOKE, MASS., JULY, 1907.

(Results obtained by using 48 spray nozzles, using 30 gallons of water per minute at 40 pounds pressure. Temperature of water, 54 degrees Fahr.)

NOTE: The upper numbers in columns three and five show conditions in "A" shed.

		Temp. of Air in Duct.			Temp. of Air Entering Room.			Temp. of Air Center of Room.			Outside Temp. in Shade.			Humidity in Room.		
		10 A.M.	2 P.M.	5 P.M.	10 A.M.	2 P.M.	5 P.M.	10 A.M.	2 P.M.	5 P.M.	10 A.M.	2 P.M.	5 P.M.	10 A.M.	2 P.M.	5 P.M.
July 1	Rain	64	66	68	69	71	72	80 80	91 83	95 84	76	87	86	60 65	46 63	44 63
" 2	"	65	67	67	68	71	71	83 78	86 81	88 82	70	82	78	61 67	59 68	54 66
" 3	Cloudy	59	60	60	66	67	67	81 78	83 80	85 80	74	76	76	50 60	50 57	46 60
" 5	Fair	62	62	62	68	68	68	78 78	90 82	93 82	74	86	78	54 62	42 60	34 54
" 6	"	63	. .	. .	70	. .	. .	80 80	. .	. .	76	. .	. .	56 62	. .	. .
" 8	"	66	64	66	70	70	71	83 81	93 84	95 84	78	88	84	64 65	42 59	42 60
" 9	"	64	64	60	71	71	68	86 84	92 84	92 82	81	85	80	52 59	54 57	34 55
" 11	Rain	61	61	61	66	66	66	80 76	79 76	77 75	67	67	63	46 66	60 67	64 68
" 12	Showers	61	65	62	66	68	68	75 73	81 76	83 78	67	72	74	69 73	59 73	52 66
" 13	Fair	60	. .	. .	66	. .	. .	80 78	. .	. .	72	. .	. .	54 61	. .	. .
" 15	"	62	64	65	68	72	72	82 79	89 82	92 83	71	84	80	56 63	48 61	56 61

TABLE SHOWING DEGREES OF HEAT AND HUMIDITY IN "B" WEAVE SHED.—CONTINUED.

		Temp. of Air in Duct.			Temp. of Air Entering Room.			Temp. of Air, Center of Room.			Outside Temp. in Shade.			Humidity in Room.		
		10 A.M.	2 P. M.	5 P. M.	10 A.M.	2 P. M.	5 P. M.	10 A.M.	2 P. M.	5 P. M.	10 A.M.	2 P. M.	5 P. M.	10 A.M.	2 P.M.	5 P. M.
July 16	Fair.	66	68	69	71	74	74	81 78	88 82	92 84	76	83	82	61 69	58 68	57 67
" 17	"	72	75	70	76	79	76	86 82	95 87	94 86	83	90	82	69 72	60 69	57 60
" 18	"	70	72	72	76	77	77	87 84	97 88	99 88	85	93	88	66 67	52 65	48 63
" 19	"	65	66	66	73	74	74	87 83	96 86	97 86	80	92	86	52 60	40 54	58 55
" 20	Cloudy	67	. .	. .	72	. .	. .	86 86	. .	. .	76	. .	. .	58 67	. .	. .
" 22	"	64	64	66	72	72	72	82 81	92 84	89 82	78	86	77	58 63	44 57	52 63
" 23	"	66	66	65	72	74	74	82 81	92 84	92 84	78	85	82	62 66	48 62	48 62
" 24	"	62	66	67	70	72	74	81 78	87 81	91 83	73	81	81	62 66	52 64	52 64
" 25	"	69	68	70	75	77	74	85 82	94 86	97 86	80	90	87	64 67	48 62	48 59
" 26	Showers	69	71	68	74	76	74	85 82	93 86	90 84	78	88	81	64 70	54 67	56 66
" 27	Fair	55	. .	. .	65	. .	. .	76 78	. .	. .	68	. .	. .	44 53	. .	. .
" 29	"	63	65	64	70	72	71	80 81	93 83	94 84	76	88	80	56 63	42 58	42 60
" 30	"	64	64	64	70	72	72	83 80	91 83	94 84	76	86	82	56 65	42 58	42 59
" 31	"	62	62	63	69	70	70	84 81	92 84	93 84	77	84	83	51 59	40 56	36 55

automatically close. These openings are utilized in winter for circulating the air from the weave room into the basement.

It has been found that this method of ventilating, cooling, and humidifying, has been exceedingly satisfactory. There are no parts of the room that are not thoroughly ventilated, and there are no "dead" spaces where condensation can occur. The air is kept perfectly sweet and clean and the conditions, as far as humidity is concerned, are good. The cooling has been very successful, as appears from the table attached hereto. The temperatures in this weave shed have been kept much lower than the temperatures in the old "A" weave shed, and on hot days have kept as low as, or lower than, the temperature of the outside air.

It is believed that this cooling tends to better work and to attract a higher class of operatives. The whole system has been so satisfactory that the Farr Alpaca Company have decided to completely rebuild their old "A" weave shed along these lines.

The PRESIDENT. Are there any questions to be asked?

Mr. W. W. CROSBY. I am much interested in what Mr. GREEN has to say regarding the construction of the gutter, particularly with reference to his use of galvanized iron in connection with the asbestos paper. I am not sure whether Mr. GREEN and the other members of the Association are familiar with the so-called asbestos protected metal, or, not, but in this connection, I should like to bring it to their attention. This material consists essentially of a sheet of steel to which is attached, by a process of cementation on each side, a sheet of asbestos felt. The gauge of the steel and the thickness of the asbestos felt may be specified to suit any local conditions. I have used this material in numerous cases, and am much pleased with it. It strikes me that in this particular situation, it would

be particularly useful, for the asbestos felt is so firmly attached to the metal that the metal cannot be injured by rusting where there might be condensation on either side. I should suppose that all the advantages of the galvanlzed iron would be conserved, with the added advantage of entire security against corrosion.

The PRESIDENT. Has Mr. GREEN any further explanation to make in regard to that question?

Mr. SAMUEL M. GREEN. I have nothing more.

ELECTION OF MEMBERS.

The PRESIDENT. The Board of Government submit with their approval the following list of candidates, recommended for election to membership in the Association which will be read by the Secretary.

FOR ACTIVE MEMBERS.

CHARLES H. ARNOLD, Supt., Grosvenor Dale Co., Grosvenor Dale, Conn. By H. D. LORD.

CLINTON W. ATWOOD, Sec'y Williamsville Mfg. Co., Killingly, Conn. By H. C. ATWOOD.

LEWIS E. BENTLEY, Agt. Taber Mill, 252 Main St., Fairhaven, Mass. By SAMUEL TAYLOR.

JAMES A. BURKE, Agt. Lyman Mills, Holyoke, Mass. By SAMUEL M. GREEN.

CHARLES B. CHASE, Supt. Lincoln Mfg. Co., P. O. Box 45, 120 Highland Ave., Fall River, Mass. By JOHN H. HOLT.

CHARLES E. COLLINS, Supt. Methuen Co., Methuen, Mass. By LEWIS E BARNES.

THOMAS H. CONLEY, Asst. Supt. Mohawk Valley Cotton Mills, Utica, N. Y. By H. F. MANSFIELD.

F. G. DANIELS, Mgr. Montmorency Branch Dominion Textile Co., Ltd., Montmorency Falls, P. Q., Canada.
By DANIEL J. DANKER.

JOHN P. DAVIS, Treas. Pentucket Narrow Fabric Mills, 287 Thorndike St., Lowell, Mass.
By CHARLES R. BLAKE.

ALBERT J. DRONSFIELD, Supt. Fletcher Mfg. Co., 47 Charles St., Providence, R. I. By ROBERT BURGESS.

HARRY S. DUCKWORTH, Supt. Print Works, Hamilton Mfg. Co., Lowell, Mass. By CLARENCE N. CHILDS.

VERNON C. FAUNCE, Supt. Hamilton Mfg. Co., Lowell, Mass.
By CLARENCE N. CHILDS.

THOMAS WILLIAM FOX, M. Sc. Tech., Prof. of Textiles Municipal School of Technology, Manchester, Eng.
By WILLIAM MYERS.

CHARLES T. GRANTHAM, Hamilton, Ont., Canada, Gen. Mgr. Imperial Cotton Co., Hamilton, Ont., Cosmos Cotton Mill, Yarmouth, Nova Scotia. By E. W. THOMAS.

C. SINGLETON GREEN, Sec'y Consolidated Cotton Duck Co , 809 Continental Trust Building, Baltimore, Md.
By E. W. THOMAS.

S. HAROLD GREENE, Treas. The Lawton Mills Corporation, 93 Federal St., Boston, Mass.
By EDWIN FARNHAM GREENE.

HERBERT H. HORTON, Treas. Troy Cotton & Woolen Manufactory, Fall River, Mass.
By ALEXANDER MAKEPEACE.

WILLIAM H. JENCKES, Supt. Nonquitt Spinning Co., 1786 Acushnet Ave., New Bedford, Mass.
By ANDREW J. CURRIER.

ALFRED LISTER, Mech. Supt. Clark Mile End Spool Cotton Co., East Newark, N. J. By W. H. LOFTUS.

SR. D. ROMÁN MACAYA, Mutua de Fabricantes de Tejidos, Carribia 6, Barcelona, Spain.
By W. D. HARTSHORNE.

JOHN MACMANUS, Supt. The Utica Willowvale Bleachery Co., Chadwicks, N. Y. By DANIEL J. Danker.

MANLEY G. MORRILL, Supt. Attawaugan Company, Ballouville, Killingly, Conn. By C. H. TRUESDELL.

RAMSAY PEUGNET, Sec'y and Treas. New York Silk Conditioning Works, 138 Spring St., New York City.
By W. D. HARTSHORNE.

ROBERT PRIEBSCH, Owner Firm Johann Priebsch Erben, Morchenstern, Post Tannwald, Bohemia, Austria.
By WILLIAM F. PARISH, Jr.

CHARLES H. RICHARDSON, Jr., Supt. Shove Mills, Fall River, Mass.
By W. IRVING BULLARD.

WILLIAM RICHARDSON, Asst. Supt. The Putnam Mfg. Co., 345 Church St., Putnam, Conn.
By GEORGE A. VAUGHAN.

JAMES H. ROSS, Firm John L. Ross & Son, 184 Church St., Willimantic, Conn. By WALTER B. KNIGHT.

JOHN H. ROSS, Treas. R. W. Lord Co., 575 Atlantic Ave., Boston, Mass.
By W. K. SANBORN.

NARAZO TAKATSUJI, Dir. and Gen. Supt. The Kanegafuchi Cotton Spinning Co., Tokio, Japan.
By H. H. FUKUHARA.

H. P. TAVEIRA, Mgr. Compantia Fabril Lisboneuse, 236 Rua da Palma, Lisboa, Portugal. By W. D. HARTSHORNE.

FREDERICH UEBEL, Member firm Gebrüder Uebel Netzschkau u. Adorf, Plauen, Saxony, Germany.
By W. D. HARTSHORNE.

BERTRAND A. WEBBER, Supt., Nottingham Mill, 314 Dyer St., Providence, R. I. By WILLIAM J. STEWART.

WILLIAM R. WEST, Prest. Mt. Pleasant Banding Co., 12 Dudley St., New Bedford, Mass.
By CHARLES M. HOLMES.

JOHN H. WHITE, Supt. Edwards Mfg. Co., Augusta, Me.
By ALBERT S. PRATT.

JOHN G. WHITTAKER, Supt. Glenlyon Dye Works, Saylesville, R. I.
By STEWART F. CARTER.

PAUL C. WILDE, Supt. Middlesex Bleach, Dye and Print Works, 3 Harding Ave., Waltham, Mass.
By CHARLES E. GETCHELL.

ARTHUR L. WILLEY, Asst. Supt., Grant Yarn Co., 41 Arlington St., Fitchburg, Mass.
By WILLIAM E. KEACH.

FOR ASSOCIATE MEMBERS.

FRANCIS W. DEAN, Mill Engineer and Architect, 53 State St., Boston, Mass. By W. D. HARTSHORNE.

JOSEPH P. GRAY, Prest. Boston Mfrs. Mutual Fire Ins. Co., 31 Milk St., Boston, Mass. By C. J. H. WOODBURY.

ALBERT H. GREEN, Kitson Machine Shop, Lowell Mass.
By HAVEN C. PERHAM.

JOHN WALTER GUMMEY, George H. McFadden & Bro., 70 Kilby St. Boston, Mass. By W. D. HARTSHORNE.

FRED M. HOADLEY, Sec'y and Treas., R. I. Contract Engineering Co., 144 Westminister St., P. O. Box 1211, Providence, R. I.
By MELDON H. MERRILL.

CHARLES E. HODGES, Asst. Mgr. American Mutual Liability Insurance Co., 50 State St., Boston, Mass.
By WILLIAM WHITMAN.

CHARLES D. LANNING, Vice Prest. and Treas. American Warp Drawing Co., 95 Milk St., Boston, Mass.
By EDGAR F. HATHAWAY.

STANLEY R. LATSHAW, Mgr. Textile Department Curtis Publishing Co., 1 Madison Ave., New York City.
By DANIEL J. DANKER.

GUY M. LINCOLN, Sec'y The Bader Coal Co., 131 State St., Room 515, Boston, Mass. By MELDON H. MERRILL.

ARTHUR D. LITTLE, Industrial Chemist and Engineer 93 Broad St., Boston, Mass. By W. D. HARTSHORNE.

J. IRVINE LYLE, Gen. Mgr. Carrier Air Conditioning Co., Taylor Bldg., 39 Cortlandt St., New York City.
By JOHN P. MARSTON.

HARRY F. NUZUM, Cotton Broker, 320 Broadway, New York City.
By DANIEL J. DANKER.

FREDERIC W. PARKS, Mem. Firm G. M. Parks & Co., 453 Main St., Fitchburg, Mass. By W. F. STILES.

NEWELL W. TILTON, Harding, Whitman & Co., 350 Broadway, New York City. By NATHANIEL F. AYER,

WRIGHT WEBB, Mgr. Boston Office, Providence Engineering Works, 131 State St., Room 503, Boston, Mass.
By MELDON H. MERRILL.

ALEXANDER S. WEST, U. S. Gutta Percha Paint Co., 53 Laurel St., Providence, R. I. By GAY D. THAYER.

The PRESIDENT. I will appoint as the committee for collecting and counting the ballots for new members Messrs. W. W. CROSBY, RICHARD H. RICE and A. G. HENRY.

The committee attended to their duty and subsequently submitted the following report.

REPORT OF COMMITTEE ON ELECTION OF MEMBERS.

The committee appointed to collect, sort and count ballots for new members, report that thirty-nine ballots have been cast,

all of which are for the list of applicants recommended by the Board of Government.

Respectfully submitted,

W. W. CROSBY,
RICHARD H. RICE,
A. G. HENRY.

The PRESIDENT. This having been the verdict of your meeting I pronounce these persons elected members of this Association.

The PRESIDENT. The next paper will be on Belts and Belt Transmission, by CHAS. F. CHASE, one of our members who is Eastern manager of the Cling Surface Company, of Buffalo.

BELTS AND BELT TRANSMISSION.

CHAS. F. CHASE, 39 Cortlandt St., New York City.

In the preparation of this paper it has been found that there is available comparatively little information on belts. Even the new International Encyclopædia claimed by its publishers to be "the one thoroughly practical educator of the day" devotes but a half page to the subject. The different kinds of belts are named but not a single rule governing their use and operation is given. But it devotes three whole pages to "weaving" and three and a half pages to "spinning."

Nearly everything printed covers the results of experiments, mostly of short duration, conducted with special apparatus. The rules given by the different writers vary between wide extremes. For example, five separate authorities differ so much in their recommendations that for the same conditions the width of a belt varies from 18 inches to 42 inches (CROMWELL). Again the number of lineal feet of *single* belting one inch wide passing around a pulley per minute required to transmit one horse power is given as 550 feet by one authority while another claims that 1,100 feet of *double* belting is required to transmit the same power (KENT, page 882). There is much difference of opinion as to the belt tension necessary for the best results, varying from 30 to 75 pounds per inch in width.

"Who shall decide when doctors disagree?"

We believe, however, that all writers do agree that more knowledge on this subject is needed. Mr. LEWIS in Experiments on the Transmission of Power by Belting (Trans. A. S. M. E. VII, 1886) says: "There is still need of more light on the subject." Mr. TAYLOR, in his Notes on Belting (Trans. A. S. M. E. XV, 1893) says: "One fact becomes more appar-

ent the further the problems in belting are investigated; namely, that what we do not know about belting far exceeds our knowledge of the subject." Mr. CROMWELL in his Treatise on Belts and Pulleys (JOHN WILEY & Sons, 1888) says: "Notwithstanding the fact that many thousands of dollars are consumed every year by the rapid wear and destruction of our machine belts, and the immense field thereby opened for the practical study and application of the principles of economy in this connection there is no branch of machine-construction which is today in as crude and unsatisfactory a state as this all important transmission by belt and pulley."

As nearly all belts are made of leather we will confine our remarks to that class. You all know that the best leather belting is made from the hides of native steers of the North and West raised in the open and slaughtered at the age of four or five years. While the chemist and experimenter have discovered a number of methods of tanning which require a shorter time to accomplish, it is acknowledged generally that none produce such good belting leather as the old fashioned "lay away" process of oak bark tanning. By this process it takes from nine to ten months from the time the hides are laid away till they are ready for the market. Before being tanned those portions of the hide unsuitable for belting (neck, belly and flank) are cut off leaving what is called the "belting butt," the usual dimensions of which are about six and a half feet long by four feet wide.

After the tanning process the "butts" are dried, in which state they are as hard as a board. They are then stuffed with greases and oils (different processes are used by different curriers) to render them flexible and fit for belting. In this process the cheaper grades of leather much of which is tanned by quick and less costly methods can be so "loaded" with glucose, sugar of lead, heavy oils and greases as to give them the appearance of good leather. To this "loaded" leather is given what is called a "hard finish" which will deceive any but an expert. Thus the unscrupulous belt manufacturer can sell with good

profit at a price absolutely prohibitive to a manufacturer who turns out only high grade belting. Both grades look alike and the inferior grade may weigh more per square foot than the other. The other day a belting manufacturer told us he had recently examined a piece of single belt made by another which weighed 26 ounces to the square foot, while his own belt of corresponding thickness weighed but 18 ounces to the square foot.

Under the new Victoria Pure Food Act every parcel of leather exported from Australia has to contain a certain certificate showing the amount of added weighting matter (sugar, glucose, epsom salts, etc.). The Boot and Shoe Manufacturers Association of this country, at their last annual convention passed a resolution designed to secure legislation to prevent or forbid the use of any foreign substance which is only used to add to the weight of sole leather. Whether it is wise or expedient for this Association to consider taking a similar action in reference to belting leather is a subject for consideration.

We are told that up to the present it has not been found possible to imitate the streak which shows the centre or back bone so that it is an easy matter to get belts made of centre stock when it is so specified. Four and a half feet is about the standard length for each sectional piece with laps. As a rule belting of the best stock will not wrinkle or "pipe" when bent back and forth repeatedly at a sharp angle. Sometimes wrinkles show at the ends of laps which are termed "fat" wrinkles. They represent the best possible grade for belting. If such laps do not exceed the standard length there is no cause for claiming that you have been cheated. A good belt should lie straight on the floor and be of uniform thickness.

Most manufacturers make several grades of belting which they usually advertise under special names. Before being made into belts the "butts" are sorted by men trained for the work just as wool and cotton are sorted before they are converted into yarn and cloth. From all this we can see that (as with oil) the buyer is really dependent on the integrity of the manufacturer. Would it not be the part of wisdom to select a concern in whom you

have confidence and trust them to supply you with that which is best suited to your conditions? If they are honest they will treat you fairly as to price.

The Encyclopædia (New International) tells us that the annual production of belting and hose leather in the United States has grown in value from less than one hundred and sixty-one thousand dollars ($160,500) in 1850, to more than ten and a half million dollars ($10,623,177) worth in 1900. Surely a product of such value commands our attention and is worthy of the careful study of all who have to do with it.

In view of the many changes tending toward economy and better operation which are continually taking place in other mechanical lines, why has the subject of belts and belt transmission been given so little attention?

Is it because the belting bills are now so small there is no desire for further reduction?

Is it because it is not known that friction costs money and that to permanently reduce it is like discovering a mine from which will flow a steady stream of the much coveted "coin of realm" so long as the wheels of the mill turn?

There may be and doubtless are many reasons. Those which occur to us are:

1. Because experiments along such lines are left to the mechanical experts or professors of technical institutions who have the time and taste for such investigations.

2. As a rule those trained for superintendents and agents of cotton mills pass through all the departments of the mill except the engine room and the machine shop.

3. The transmission department (engine, belting, etc.) is in charge of one who has all he can do to keep the wheels turning, and who has no time nor inclination for anything that involves extra work.

4. Of the deep rooted trait in human nature to "let well enough alone," and

5. The subject has not been brought to the attention of those vitally interested in the dividends of a plant with sufficient force to induce them to believe it "worth while."

So far as our observation goes, except where the method about which we are to speak presently is followed, belts today are run as they were when their use began.

The money losses due to the ordinary management of belts may be classed under two headings:

1. Tight belts.
2. Belt slippage.

On this subject Jones & Laughlins quote the following from a New England cotton mill engineer of high reputation: — "I believe that three-fourths of the trouble experienced in broken pulleys, hot boxes and etc., can be traced to the fault of tight belts. The enormous and useless pressure thus put upon pulleys must in time break them, if they are made in any reasonable proportions, besides wearing out the whole outfit, and causing heating and consequent destruction of the bearings. If manufacturers realized how much this fault of tight belts cost them, in running their mills, probably they would 'wake up.'"

Below are some figures showing the power it takes in average modern mills, with first class shafting, to drive the shafting alone (friction load.): —

Mill.	Horse Power.		Horse Power.	Per cent. of Whole.
	Whole Load.	Shafting Alone.		
1	" 199	"	51.	25.6
2	" 472	"	111.5	23.6
3	" 486	"	134.	27.5
4	" 677	"	190.	28.1
5	" 759	"	172.6	22.7
6	" 235	"	84.8	36.1
7	" 670	"	262.9	39.2
8	" 677	"	182.	26.8

These may be taken as a fair showing of the power that is required in many of our best (not worst) mills to drive shafting. It will be seen that the percentage is large — from 22 per cent. upwards. It is unreasonable to think that all that power is con-

sumed by a *legitimate* amount of friction of bearings and belts. It is out of all reason, and I know of no cause for such loss of power but *tight* belts. These, when there are hundreds or thousands in a mill, easily multiply the friction in the bearings and would account for the figures.

Taking the cost of a horse power at 35 pounds coal per day, per horse power, and allowing 15 per cent. of the whole load as a reasonable loss from friction one can see that the cost of running tight belts is no inconsiderable one, to say nothing about the loss resulting from the shortened life of the entire equipment."

We are told that a mill with 1,000 looms running on print cloth will turn out about 5,000 pieces per week. If there is an average belt slippage throughout the plant of 2 per cent. (Do you take the speed of your various lines of shafting at full load and again at no load to ascertain what the slippage is?) there will be a loss of 100 pieces per week. Figuring the value of each piece at $2, it will amount to $200 per week or $10,000 per year. It will pay to go to a good deal of trouble to prevent such a loss.

When is a belt tight in the sense of being "too tight" and when is a belt not "tight enough?" The tightness of a belt is not ordinarily criticised until it causes a hot bearing. On the other hand a belt is considered "tight enough" until slippage becomes apparent to the senses, or until as we have been told it is customary in some mills, the regular time comes round to shorten (tighten) every belt in the plant.

From our point of view any belt is "too tight" that is wasting power in friction that can be easily saved, while any belt is "tight enough" that runs all right, does not slip, and has sufficient pulley contact to keep well within the strength of the leather to withstand the strain put upon it.

We believe in regularly feeding a belt with that which will make and keep it healthy, just as you believe in regularly oiling a bearing. You, of course, know that every fibre of a belt in motion is constantly changing its position in relation to its

neighbors so that a lubricant is needed to reduce internal friction just as oil is needed in a bearing. Withhold the lubricating food and the fibres will get dry — the whole belt will grow hard, crack, slip, and its life will be shortened. We believe further that in general to shorten (tighten) a belt is like beating a horse when it is time to feed him. The effect on both is the same, namely, it takes the life out of each of them.

Eleven years ago the Cling-Surface Co. of Buffalo began to introduce a belt food called Cling-Surface. The test of time has substantiated their claim that its use makes possible the transmission of power with practically no belt tension.

Feed all of your belts with it, applying regularly as it can be absorbed and tight belts are no longer necessary. They will not slip. When a belt is properly *filled* with Cling-Surface it is permanently benefited and will *never* get dry and hard again. It can be figured as an asset always because a pound of Cling-Surface put into a belt stays there and is worth more there than when in the can.

It is natural to look askance at that, the claims of which tend to overthrow the rules of existing practise. It has always been so. There may be those in this room today who could have become independently wealthy had they purchased Bell Telephone stock when a generation ago it went begging at a few cents per share.

The intelligent use of this food in all belts (not the few troublesome ones only) to its full extent will accomplish the following:—

1. Your friction load will be reduced at least five per cent. and may be twenty per cent. How many tons of coal per year will this represent?

2. Your belt expense (including lacings, cement, etc.) will steadily grow less.

3. Your Sunday work tightening belts will be cut out. How many dollars did you spend for this in 1907?

4. Your product in all departments will appreciably increase and its quality improve.

5. You will sell less waste in proportion to your product than ever before.

6. Hot boxes will be unknown in your mill.

7. Your belts, rope drives and spindle bands will be unaffected by atmospheric changes. You will no longer dread fogs or dog days.

8. Your main belt (or any other) in time of flood will not come apart if the water reaches it.

9. Your shafting and hangers will not come down when excess loads come upon the belts suddenly.

10. Your mill will start up Mondays on time.

Figure these ten items of saving in dollars and cents. You will be convinced that the careful feeding of belts will pay and pay well. But it must be done with system along well defined lines. Personal prejudice or lack of interest is fatal to success in any line of investigation.

Each belt is a law unto itself and must be treated accordingly. "Sick" belts must be diagnosed with care. Their present condition and previous treatment considered before the feeding begins.

As no two things in nature even of the same kind are exactly alike so no two belts are exactly alike nor are any two laps in the same belt exactly alike. Therefore it is manifestly impossible to accurately form a judgment until not one but a number of belts (of which some should be new) have been fed for some time according to the best knowledge on the subject.

The bad effects of previous treatments are not always manifest until some time after the proper treatment has been in progress.

As it is the legitimate function of some belts to slip it may not always be wise to subject such belts to a treatment one of whose most valuable features is to stop all slippage.

Today more than ever before is it necessary to the highest success in any business that "leaks" both big and little shall be stopped. The attainment of this desirable end is not always easy.

In the proper care of belting good judgment is the great

essential. This quality is the possession of each member of this Association or he would not be in the position he now holds. A technical education is not necessary. It must be borne in mind, however, that nothing in this life worthy of attainment is accomplished without effort. Perserverance will bring success.

The following pages show two diagrams from Prof. CARPENTER'S report and photographs of belts in operation which before being filled with Cling-Surface slipped even when run with excessive tension.

The machine which we have here while little more than a toy demonstrates that a belt properly filled with Cling-Surface will when running slack transmit more power than a similar untreated belt running tight.

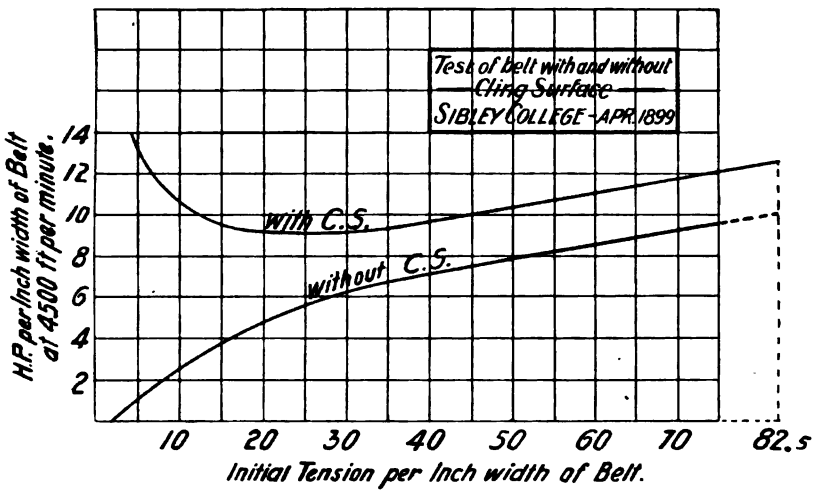


FIGURE 1. — PROFESSOR CARPENTER'S REPORT.

Upper curve shows C. S. belt at its slackest, delivering 40% more power than the untreated belt at point of greatest tension, and with relief at all points.

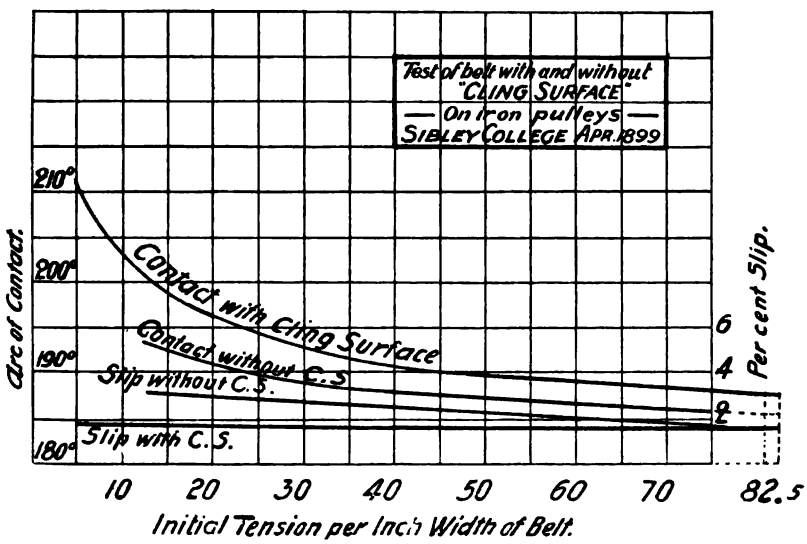


FIGURE 2. — AMPLIFIES FIGURE 1.

Showing area of contact at time of highest delivery was 210° and slip under 2% (2% being the ideal minimum of best practice). Compare with untreated belt.

FIGURE 3.—NEAR VIEW OF CLOSE AND INCREASED CONTACT OF BELT ON PULLEY FACE.

FIGURE 4. — POSSIBILITIES IN RUNNING CROSS BELTS FREE FROM TENSION AND FRICTION.

FIGURE 5. — RESULTS ON AN ALMOST VERTICAL BELT, SHOWING INCREASE OF 63° IN BELT CONTACT ON LARGE PULLEY, AND 33° ON SMALL.

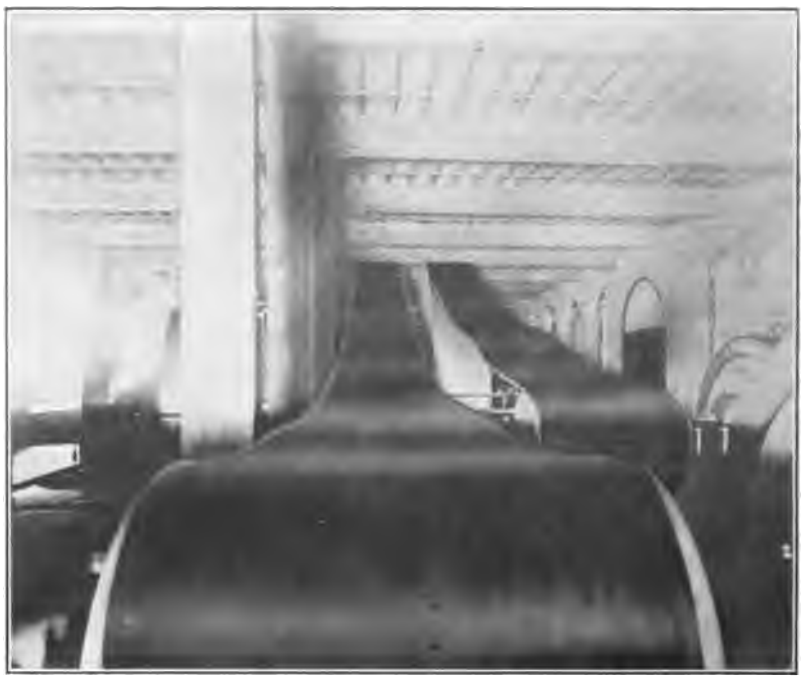


FIGURE 6.—SHOWING POSSIBILITIES OF MANAGEMENT OF LARGE DRIVES (40″) WITH THEIR PRESERVATION AND PLIABILITY.

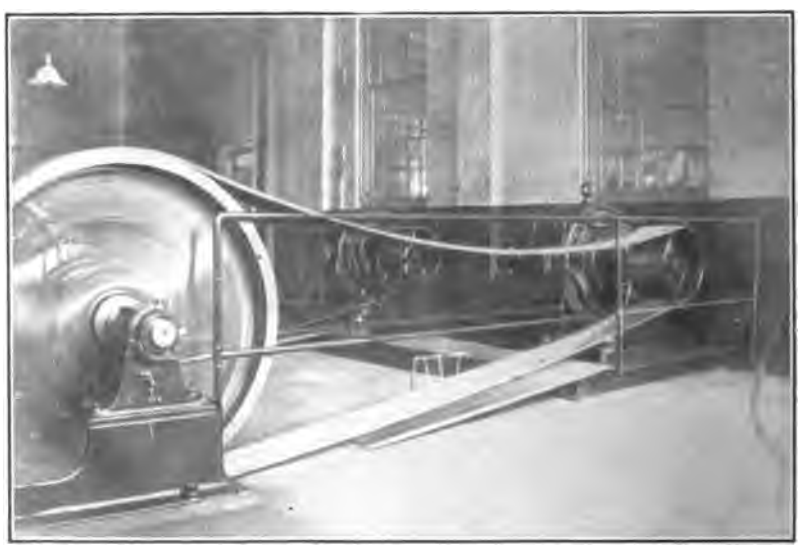


FIGURE 7.—AN EXAMPLE OF CURE OF STATIC ELECTRICITY TROUBLE.

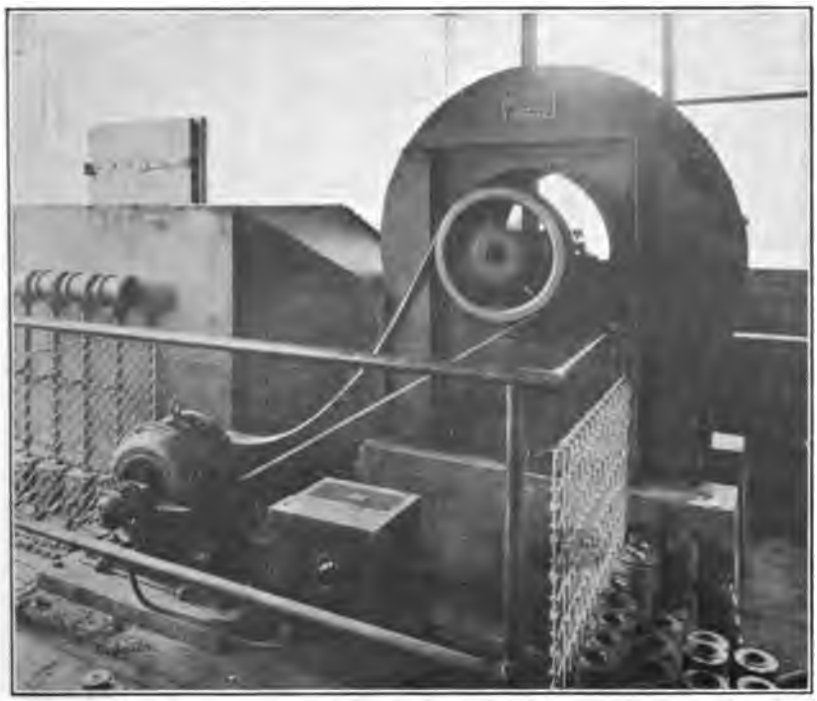


FIGURE 8.—SHOWING THE POSSIBILITY OF RUNNING SLACK BELTS ON VERY SHORT DRIVES.

FIGURE 9.—MAIN (24″) BELT WORKING, WITH MAXIMUM LOAD (150 H. P.) WITH IDLER REMOVED.

FIGURE 10.—ROPE DRIVE EXPOSED TO THE WEATHER.

The PRESIDENT. Does any one wish to ask any questions upon this paper? Mr. DRAPER, have you something to ask?

Mr. GEORGE OTIS DRAPER. Mr. President, I thought I understood the speaker to suggest that this Cling-Surface might be used on spindle bands,

Mr. CHAS. F. CHASE. Yes, sir.

Mr. GEORGE OTIS DRAPER. Is that your theory, or do you know of mills that actually do use it on spindle bands?

Mr. CHAS. F. CHASE. I know of one mill, one of the largest cotton mills in this country, which has been using it on its spindle bands for a number of years, so I was told the other day by a man who had come recently from that mill.

Mr. GEORGE OTIS DRAPER. Now, spindle bands are made of various substances. Do you know what these spindle bands were made of?

Mr. CHAS. F. CHASE. I do not.

Mr. GEORGE OTIS DRAPER. I have been a great deal interested in the subject of spindle banding for a great many years and I was quite interested in your suggestion, and any information you could give me on the subject I should be pleased to have.

Mr. CHAS. F. CHASE. There is one point, perhaps, that may be of interest, and that is this; in looking into the matter personally I have found that in one type of spinning machines the whorl is too high on one side of the drum and too low on the other side to make a mechanically correct drive for the lead of the band, so that the use of Cling-Surface on such a machine is not practicable for the very reason which is one of its chief points of value, stopping slip. A Cling-Surface treated spindle band on such a machine, instead of slipping down into the bottom of the whorl, as an untreated band will slip, simply rides right up in its effort to run mechanically correct, and up and out she goes. Now if the machine could be made a little "skewgee", as it were, so as to have the whorl in line, I am quite sure that success could be obtained in a very large measure.

The PRESIDENT. Has any one else any question to ask?

Mr. JOSEPH MERRIAM. Is it used on mule bands where the pulleys are all vertical?

Mr. CHAS. F. CHASE. I cannot personally answer that question, but I can say in general that the use of Cling-Surface in any cotton or rope or leather will act as a preservative, will make it waterproof, will increase its life and will prevent slippage.

The next paper is on "Steam Turbines," but Mr. MELDON H. MERRILL, well known to us as a mechanical engineer, and who has read papers before us before.

STEAM TURBINES FOR TEXTILE MILL POWER.

With Special Reference to the More Recent Improvements of the Westinghouse-Parsons Turbine.

MELDON H. MERRILL, Boston, Mass.

In the successful operation of any power system, the prime mover is, of course, but one factor contributing to its success, and, before the final results may be observed in the character and quality of finished product, several other factors intervene, any one of which serves to limit the effectiveness of the system as a whole. Thus, in cotton mill work, boiler plant, generating plant, distribution system and induction motors, all intervene as factors in this complete problem. They are coexistent with, and yet independent of the prime mover. But, in spite of this fact, it is true that, after all, the prime mover calls for perhaps the largest share of consideration. There may be some difference of opinion upon this, but there remains the fact that the modern system of electric distribution by motor drive, has been developed to a state of such efficient and reliable service as to relieve us from any extended consideration of this subject for the present. Moreover, electric distribution is becoming very largely standardized, which cannot be said to apply to the steam power plant, except as regards a particular type of apparatus.

It is, therefore, assumed at the outset that the electric system of power distribution has reached a state of perfection such as to merit your serious consideration and ultimate adoption. The comparative merits of motor versus rope drive, therefore, have no place in the present discussion. And, as the most effective application of the reciprocating steam engine is in connection with direct rope drive, we are, therefore, brought to a considera-

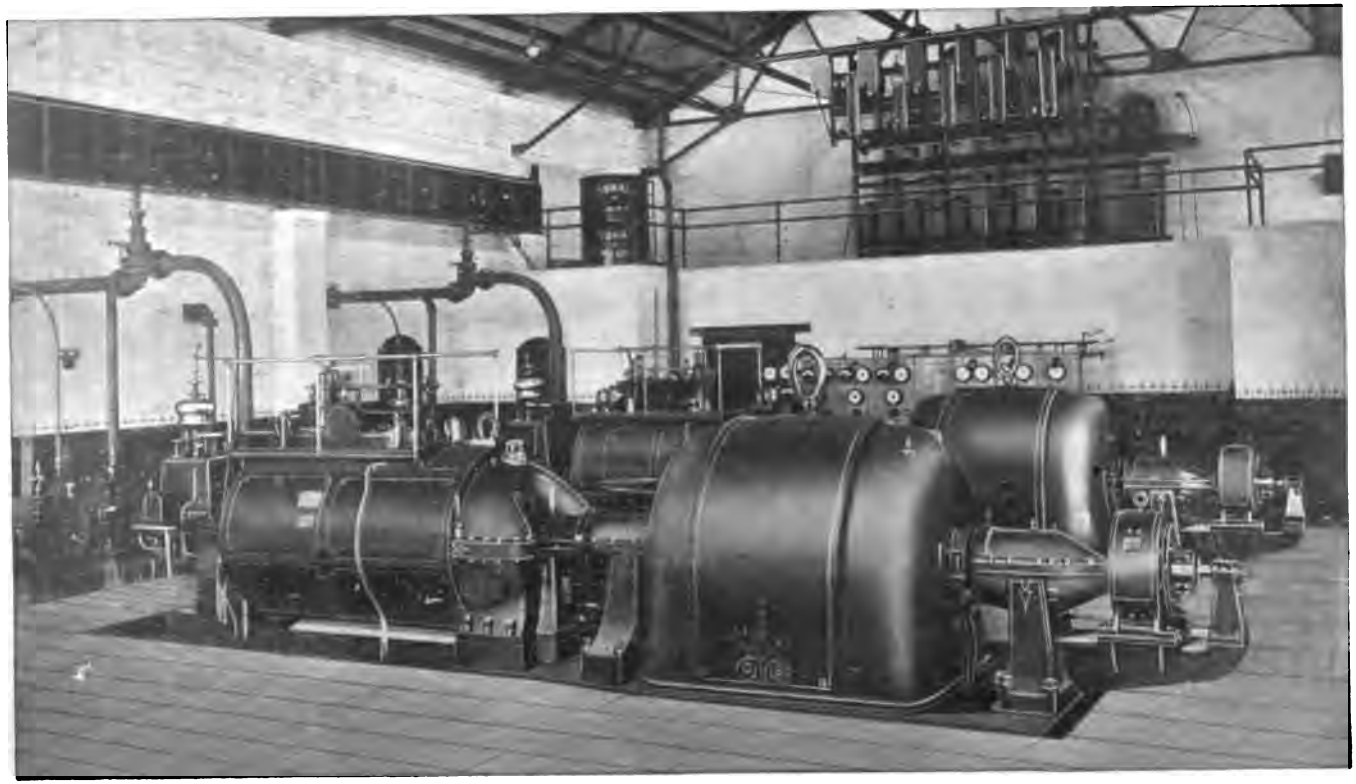


FIGURE 1.—PITTSBURG AND BUTLER STREET RAILWAY POWER STATION.

tion of the turbine as a prime mover, either hydraulic or steam, excepting in locations where the price of fuel favors the adoption of the gas engine.

In order to form a dispassionate and unbiased opinion of the intrinsic merits possessed by the steam turbine for cotton mill work, how shall we best approach the problem? The field of observation is comparatively narrow, there being but two principal types on the present market which can be considered as developed. Shall we, on the one hand, give ear, up to the limit of our patience, to the man who proclaims a monopoly upon every conceivable advantage under the sun, and out of a hopeless, confused mass of exaggerated claims and unfounded assertions, endeavor to extract a modicum of truth by process of elimination, or shall we "take the bull by the horns" and go straight to the fundamental facts which underlie all successful development?

And what are these? Naturally, the matters of greatest concern to the cotton mill operator, are: First, *reliability;* for many different processes depend upon the continuity of service from the power plant. That *simplicity* in operation is one of the most impressive features of the steam turbine is true, but a secondary consideration. Second, *uniformity of speed.* Here the turbine stands predominant in the entire absence of cyclic speed variation, due to the absence of reciprocating motion, which, even with a perfected steam engine, requires such careful consideration. This is of particular importance in cotton mill work, as any variation in speed affects directly the productive capacity of the plant.

Third, *economy*, not alone of fuel, but in all attending expenses, foundations, space, supplies, maintenance, attendance and fixed charges on the investment.

Now, these three factors practically constitute the basis of your ultimate judgment, but an adequate consideration of all these matters is, of course, outside the scope of any one paper. We will, therefore, narrow down our inquiry to the construction of the prime mover, the design of which allows the complete

fulfillment of the predominating features just outlined, and, although I shall strive to avoid wearying you with unimportant detail, yet I cannot help but feel that your final judgment will bear me out, that the kernel of the solution lies in these same details.

What is to follow deals largely with recent improvements in construction, all of which have an important bearing upon reliable and efficient running, and for the reason that the Parsons turbine principle has never been adequately presented before this Association, I have purposely covered some details which might otherwise have been omitted. By necessity, some comparative references to intrinsic features of other designs are made, but this is avoided as much as possible.

Westinghouse Turbine Development. By way of introduction, it is well to briefly summarize here the extent of turbine development recorded since the beginning of active operations at the Westinghouse plant, East Pittsburg, in 1899. At the close of the year 1907, there were entered upon the records a total of over one and one quarter million horse power in turbine machinery; three quarters of a million horse power was at that time in operation or under erection, and the balance in various stages of manufacture for order and stock. Between the years 1904 and 1908, the turbine production has more than doubled each year, and, with this rapid development, it is gratifying to note that the textile mills lead all other industrials, and, relatively compares very favorably with traction and lighting plants. This is particularly interesting, owing to the fact that the majority of textile installations to date have been additions to existing steam engine plants.

The lesson this great development in turbines possesses for the cotton mill engineer is that the accumulated experience acquired by the builders is embodied in the present design, which is a most valuable asset in his favor. Furthermore, the fact that nearly all Westinghouse turbines (well over ninety per cent.) are paid for within three months of completion of installation, furnishes an effective commentary upon the general sat-

isfaction which prevails among turbine users. We will now consider the specific points of design.

Principle of Operation. Like the hydraulic turbine, the steam turbine is simply a mechanical means of transferring to a rotating bucket wheel the kinetic energy of a rapidly moving fluid jet. These principles have already been outlined in sufficient detail in previous papers before the Association. One fact, however, has not been made sufficiently clear, viz.: that, with high velocity steam, mechanical erosion of all metal in contact with the steam, is bound to occur, especially with steam containing entrained moisture. Realizing the difficulty of constructing turbines of the single-wheel impulse type, possessing the desired strength, high efficiency and long life, Mr. PARSONS finally developed the multi-stage expansion turbine. In this system, the steam is only partially expanded in each row of blades, *i. e.*, the energy of the steam is removed step by step. Hence, the bucket and jet velocities need be but a fraction of those necessary in the single-stage turbine, and it becomes possible to construct commercial machines of high economy and operating at comparatively low bucket and shaft velocities. The Parsons multi-stage turbine may be classed as embodying the combined impulse and reaction principle, *i. e.*, the steam acts upon the moving blades partially by impulse and partially by reaction. This will be better understood by examining Figure 2, a diagram of the two consecutive states of a Parsons turbine.

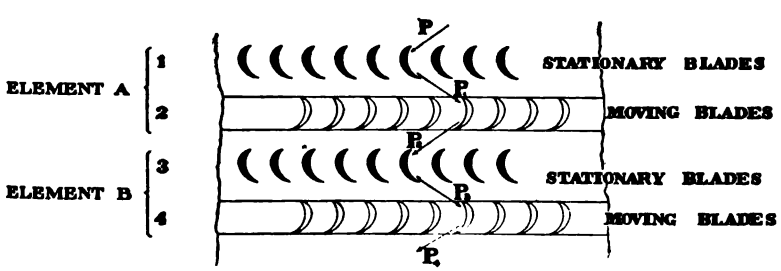


FIGURE 2. — BLADE DIAGRAM.

The steam enters the first row (1) of blades at boiler pressure and expands a few pounds to a lower pressure (P 1), acquiring a velocity and impinging upon the first row (2) of moving blades. Here its velocity is reduced and the energy of the jet partially given up to the moving blades. But, while passing through the first row of moving blades (2), the steam expands further in the moving blades and again acquires velocity by the time it reaches the exit of the first row of moving blades. Thus, the force required to accelerate the steam in the moving blades (2), is transmitted back to them and thus delivers more energy to the first row by reaction. This process is repeated a sufficient number of times (from fifty to seventy, depending upon the size of the turbine) to abstract the energy in the steam and transfer it to the moving blades. What is the result? By means of this many-stage principle, we have effected complete expansion of steam from boiler to condenser pressure without having exceeded at any point in the expansion a velocity of 600 feet a second, or about 450 average, as compared with 4,000 in a single bucket wheel and about 2,000 in the turbine of not more than four stages. Furthermore, we have transferred a greater quantity of heat energy in the steam into useful work than is possible with the average reciprocating engine; sixty-five to seventy per cent. and even higher in the low pressure turbine.

Construction. Returning now to the actual construction, we will consider the 1,000 kilowatt turbo unit shown in Figure 3, as representative of the present Westinghouse–Parsons system up to capacities of about 3,000 kilowatts.

Turbines of this type are already operating in the field up to 7,500 kilowatts capacity, and several machines of 10,000 kilowatts are either under erection or building, for the Kent Avenue Station of the Brooklyn Rapid Transit Company, New York, one of the largest stations in the country and exclusively equipped with Westinghouse turbines. These machines represent the largest single turbo units ever constructed for power work, and will have a guaranteed over-load capacity of 22,000

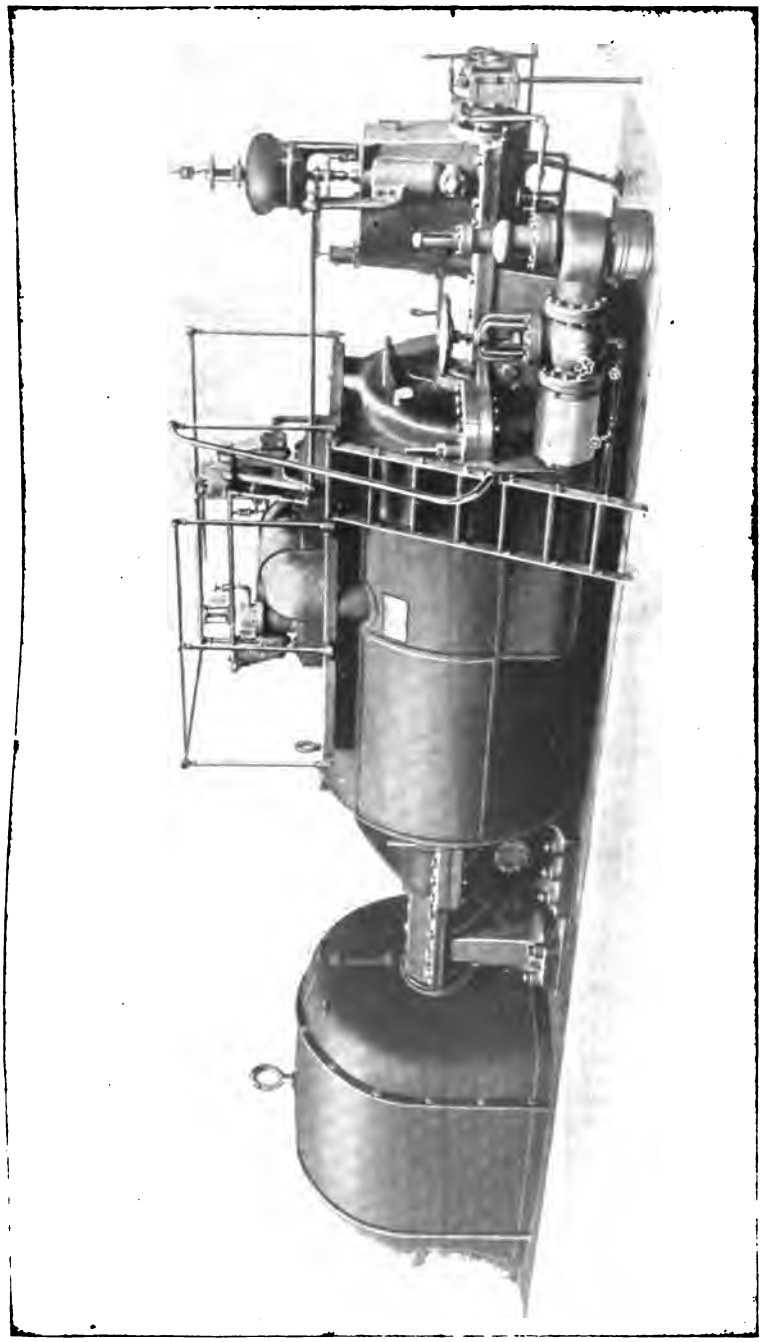


FIGURE 3. — WESTINGHOUSE PARSONS TURBO UNIT, 1000 K. W.

brake horse power, which would be equivalent in the reciprocating engine, to an output of 25,000 indicated horse power. It is unnecessary, however, for the purposes in view, to consider the special construction of these large units. In Figure 4 a turbine is shown with some of its parts removed for inspection. This view should be studied in connection with Figures 5 and 6. These three views speak volumes for the man who thinks it worth while to inspect his machinery at intervals.

Stator. Briefly, the turbine consists of two parts, the stator or cylinder and the rotor or spindle. The stator is built in two parts, as shown, the upper carrying the admission valves and distribution passages, the lower cast into two pedestals. At the exhaust end the cylinder is anchored to a rigid, continuous bed plate, while the outer pedestal is permitted to slide between guides, thus providing for expansion and contraction of the turbine along its axis. Inasmuch as no live weight comes upon the cylinder corresponding to the moving weight of the reciprocating engine piston, the structure is simply that of a cylindrical envelope carrying its own weight from two supports. The cylindrical section gives the most rigid structure and avoids entirely any allowance for sag or vertical deflection.

Rotor. For a similar reason the spindle is built up from a hollow central shell, into which are fitted slide shaft ends forced into place and retained by shrink links. This allows a light but rigid structure in which the sag is practically negligible. In spite of this fact, the horizontal design of turbine has been unjustly criticized as being greatly affected by sagging between bearings; a practically non-existent factor. The rotor is not built in one piece, but consists of a number of sections threaded in succession upon the spindle. Each section is not only balanced individually, but also the entire spindle after completion, so that the effects of unsymmetrical distribution of metal are brought to a minimum.

Contrary to the general impression, the three diameters of blade drums are employed simply for mechanical convenience in blading, and not on the triple expansion principle. Note

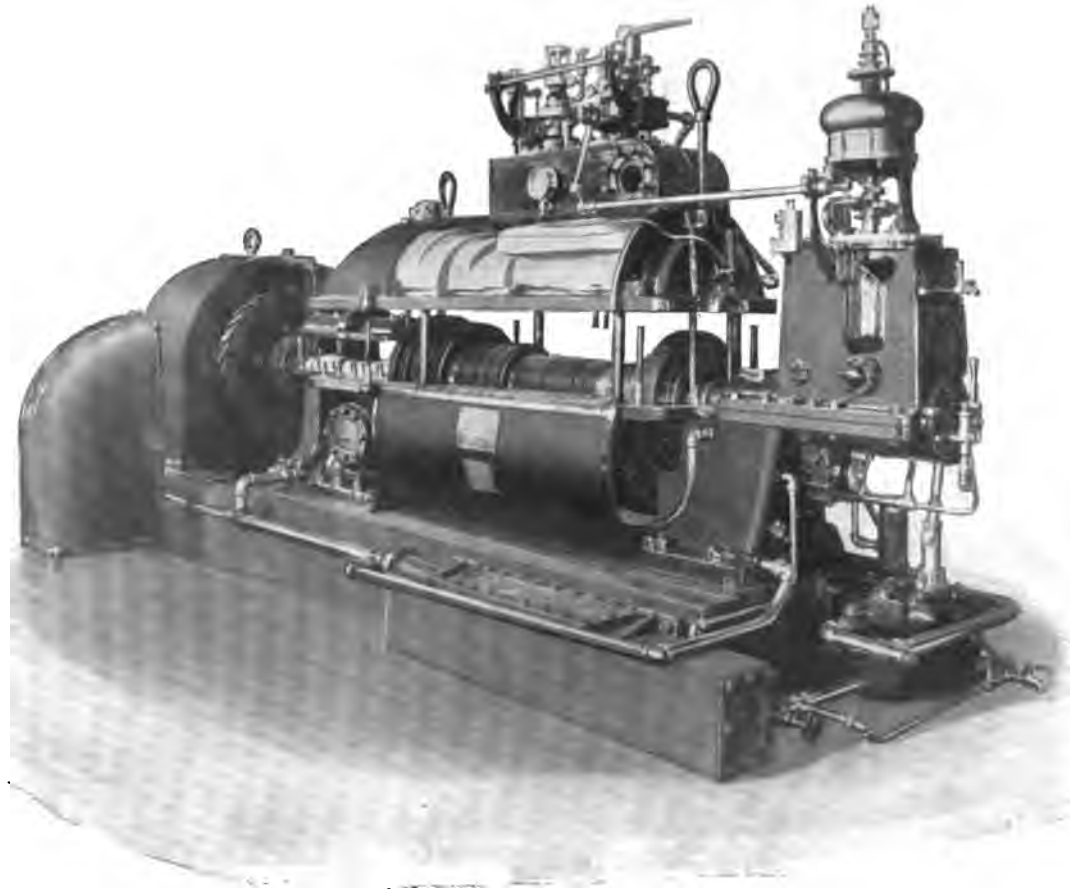


FIGURE 4. — WESTINGHOUSE PARSONS TURBINE, OPEN FOR INSPECTION.

that each drum carries shorter blades at the beginning than the end of the preceding drum. Were only one drum employed, from fifty to seventy different lengths of blades would be required for each size of turbine. This increased diameter reduces the stock to a few sizes, still maintaining the proper steam areas.

Referring to Figure 5, steam enters through the strainer (S) and primary admission valve (V) to the distribution port (A) which delivers to the entire periphery of the rotor. From this point the steam expands down to condenser pressure through successive stages, already represented by diagram in Figure 2. Here the *entire space* between rotor and stator walls is filled with a positive flow of working steam, this steam area increasing by gradual steps according to the volume which the steam occupies at the various pressures. There are no idle spaces in which eddies can exist and fluid friction ensue.

The drop in pressure from stage to stage in the Parsons system would naturally result in a very considerable end thrust along the axis, varying with the load and the pressure distribution. Marine turbines utilize the reverse thrust of the propellers for equalizing this steam thrust, but in the stationary machine three rotating balance pistons (P), (P), (P), are used, each of just such diameters as to exactly balance the thrust of the steam for any condition of load, steam pressure, or vacuum.

Equalizing passages (E), (E), (E), serve to maintain this exact pressure balance which is so sensitive that the turbine shaft practically floats in its bearings and can be moved either way by the pressure of a pencil point. These balance pistons (P), (P), (P), retate without friction, yet are steam tight owing to the deep corrugations on the periphery, forming what is known as labyrinth packing. Although no actual end thrust exists, it is naturally necessary to maintain the rotor in a definite axial position. This is accomplished by an adjustable collar bearing (T). The two halves of this bearing are adjusted by set screws above and below, each graduated to register one one-thousandth of an inch movement of the shaft. By this means, running clearances may be readily checked at any time, a valuable feature.

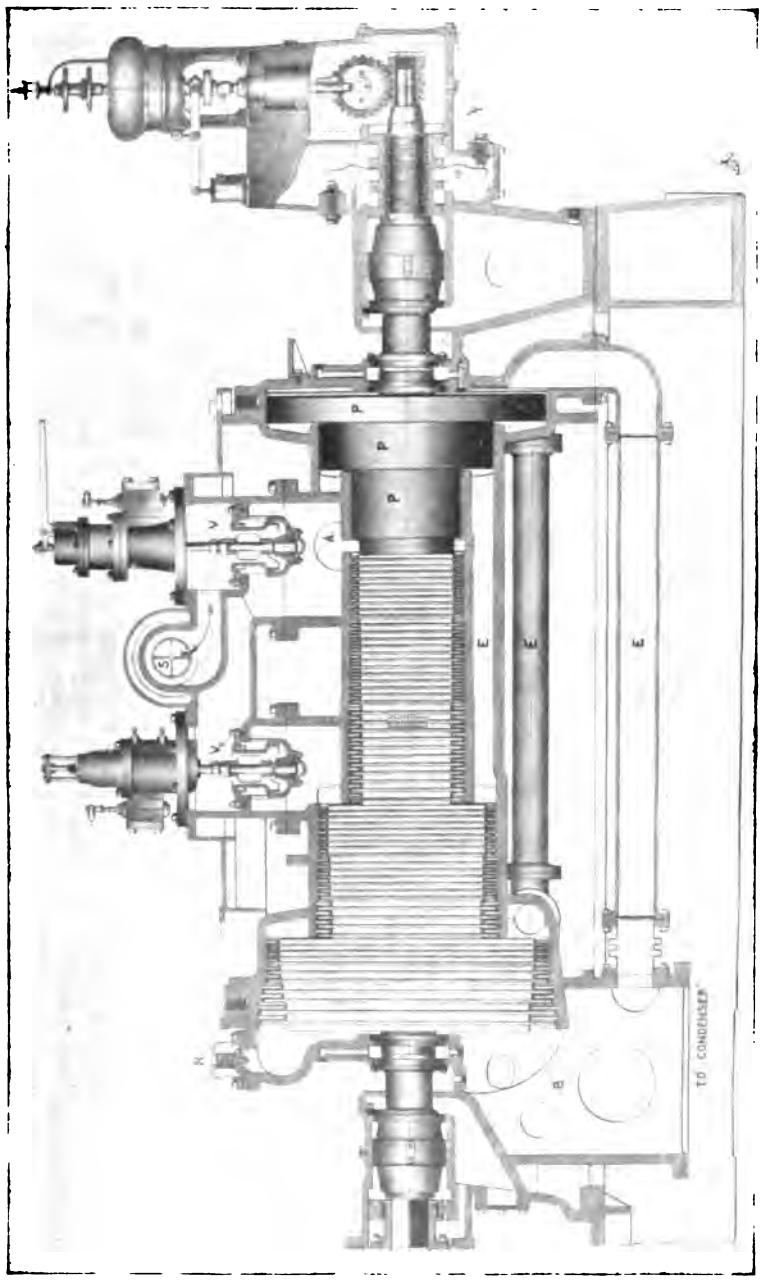


FIGURE 5.—SECTION OF TURBINE.

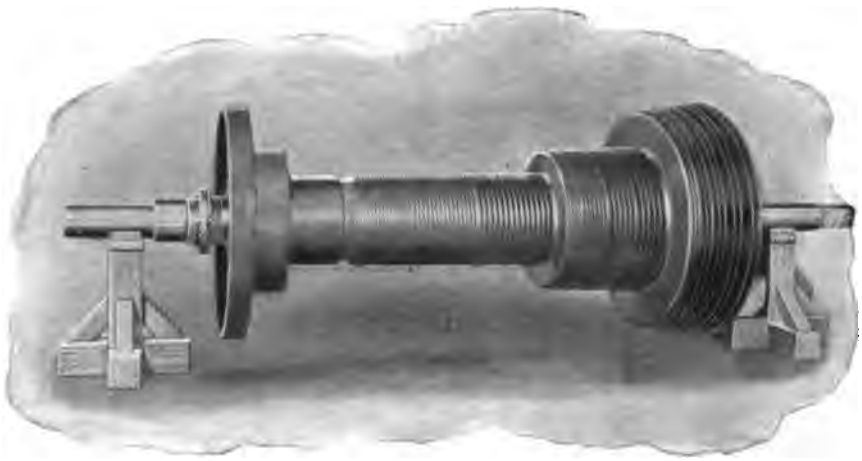


FIGURE 6.— ROTOR.

Over-load Valve. The normal steam passages are designed to handle steam up to a point where the governing valve is wide open and where would occur the limit of the machine's capacity, but, at this point a secondary valve (Vs) admits steam from inlet (A) around into the second drum, which is of larger diameter. This in effect, serves to increase the mean effective pressure of the expansion through the later stages, in some such manner as high-pressure steam is by-passed into the intermediate cylinder of a triple expansion engine to increase the maximum capacity. Here we have added little to the turbine, yet have secured an enormous overload capacity with little loss in economy, as will be outlined later; and, in addition, full load capacity when forced to operate without a condenser.

Blading. Owing to the relatively minute pressures actually exerted upon each individual blade, the most desirable characteristics of a Parsons blading material, are not maximum physical strength, but rather ability to withstand high temperatures without deterioration, and the corrosive effect of impure water. Moisture always occurs at some point in the expansion of steam, even if super-heated, hence, toughness is to be desired in the blade. Several materials have been successfully used in

Westinghouse turbines, viz., bronze, steel and hard copper. None of these materials combine all the desired physical characteristics to be universally applicable. With pure water, steel has unquestionably proven an excellent material. With corrosive water, bronze or copper has been used to better advantage.

In the last year, however, a special material, known as duplex metal, has been developed, and is now exclusively used in Westinghouse turbines. This material is manufactured by a secret process and combines the structural strength of a steel center with the protective qualities of the copper sheath. The two metals are welded so perfectly that the material can be drawn to the required blade section without altering the thickness of the sheathing, an enlarged section of this blading is shown in Figure 7, in which the uniform thickness of the sheathing can be readily discerned. This copper sheath provides great resistive qualities against chemical erosion without altering the strength of the blade.

FIGURE 7.—BLADE SAMPLE.

This blading is drawn into long strips cut to length and mounted in tapered slots in stator and rotor with soft steel spacers. These are of a precise section, so proportioned as to give the proper steam channels between blades, and, after assembling, are caulked firmly in position, the soft metal spreading into the dovetail, and gripping the blade so tightly that it will pull apart before pulling out. Furthermore, with

steel in blade, spacer and spindle, there is no opportunity for the blading to become loose by unequal expansion at high temperatures.

One of the most effective details of the present design is the method of lashing together the tips of the longest blades for the purpose of re-enforcing them and maintaining the proper spacing. Figure 8 shows this in detail.

The lashing is drawn in long strips with a section resembling an inverted "comma." The tips of the blades are punched to a corresponding section and threaded on to the lashing in sections two or three feet long, which considerably facilitates assembling of the blading. When the blades are finally caulked in position, the "tail of the comma" is sheared over by a tool, as shown, wedging tightly between the contracting faces of the blades, while leaving intact the round section of the lashing, as well as the short strip or key within the punched blade. This results in several important features: First.—A continuous tie wire of circular section re-enforcing the blade tips and forming practically no obstruction to the steam flow. Second.—A strut or spacer wedge between the adjacent blades. Third.—A key or wing left within the blade section, serving to prevent a broken blade twisting around the lashing wire. Fourth.—The lashing may be located at any desired point on the blade to prevent intermediate or nodal vibration of the longest blades, should there be any such tendency. Fifth.—It is easily replaceable, permitting the insertion of one or two new blades without necessitating the removal of an entire ring. Sixth.—The lashing cannot warp so as to distort the blading, nor can it release itself as the result of rubbing and thereby communicate serious damage to other parts. The blades only require punching, no riveting being necessary, and the work of final gauging of the blades is accomplished before the lashing is finally secured, and, hence, without weakening its grip. An average sample of the finished blading is shown in Figure 9, which illustrates the striking uniformity possible with blading assembled by hand. It also shows the lashing wire in position. Past experience has demonstrated

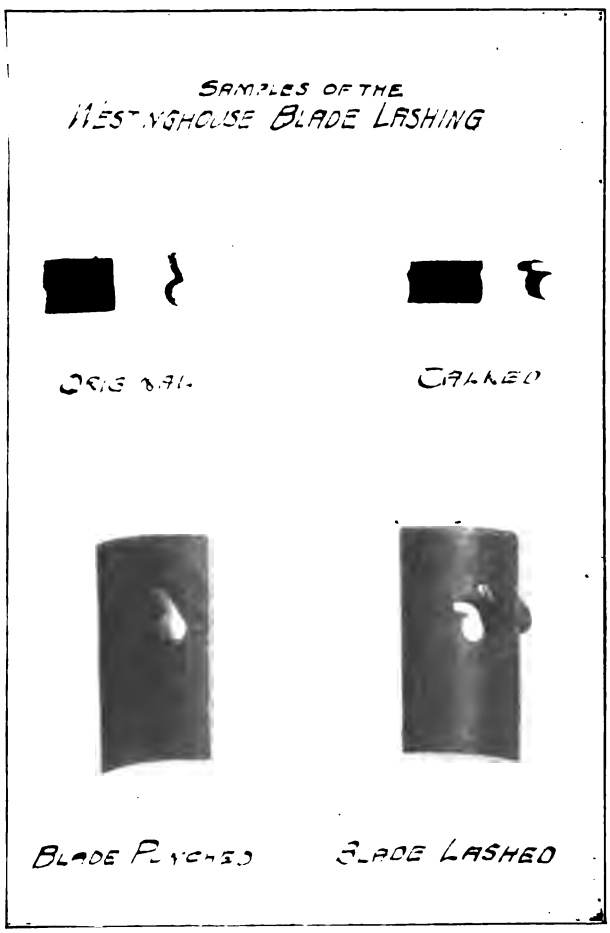


FIGURE 8.—COMMA LASHING

that turbine blading can be made too rigid, and the design here illustrated was adopted with this point in view. It possesses ample strength and rigidity for all normal conditions of operations, yet in an emergency, its failure will not tend to spread over a considerable region, but will be confined to the locality of the defect.

FIGURE 9.—FINISHED BLADING.

Governing. In the Parsons type, two methods are in general use for governing the admission of steam according to the load. In one the steam supply is simply throttled so that the inlet pressure varies with the load. In the Westinghouse system, steam is admitted in puffs of approximately full pressure and occur at regular intervals. The duration of the puff, however, is controlled by the governor according to the load, by allowing the valve to seat sooner or later, as the case may be. Figure 10 shows this governing system comprising a sensitive centrifugal governor working against adjustable spring pressure, and varying the position of the moving fulcrum (F). In so doing it changes the position of a small pilot valve (A) which controls the exhaust from a cylinder (B) actuating the double poppet valve shown in detail in Figure 5.

In addition to this motion, however, a reciprocating motion of uniform range is communicated to the governor linkage from an eccentric rod (*C*) acting about a fixed point (*D*). This eccentric determines the number of puffs of steam admitted (about 165 puffs per minute), while the governor fixes the relative position of the pilot (*A*). This system entirely avoids the

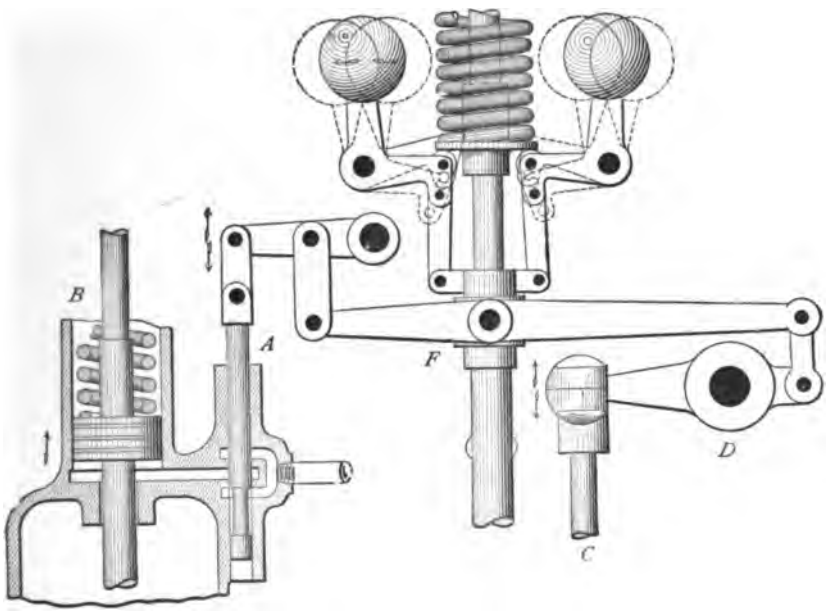


FIGURE 10. — GOVERNOR DIAGRAM.

possibility of sticking of the governor, as all parts are constantly subject to a slight motion. It also avoids to a great extent, wearing of the valve seats which occurs when steam is simply throttled. And, as the governor is not loaded with the friction work of moving heavy valves, a high degree of sensitiveness is possible, in fact, more than is necessary for average conditions of parallel operation in alternating current systems.

The accompanying report (Table 1) of a test on a turbine now in service in a southern cotton mill shows a drop in speed of less than three per cent. at full load, or a total speed variation from one-half load to load and one-half, of only 1.84 per cent. of the speed at full load. Within the more usual range of load three-quarters to load and one-quarter, the speed variation would approximate one per cent., and can be made less, if desired.

Table I.

SPEED REGULATION TEST.

500 K.W., Westinghouse, Parsons Turbine No. 209.

From report of test by Messrs. Ludwig & Co., Engineers, Atlanta.

	Test No.				
	8	1	2	3	4
Nominal load,	No.	½	¾	full	1½
Speed Rev. per min.,	3663.7	3623.3	3,604.4	3,555.3	3,539.0
Variation from no load run,		40.4	59.3	108.4	124.7
Variation from no load %,	0	1.1	1.62	2.96	3.39

Speed variation from ½ to 1½ load per cent. full speed,	1.84 per cent.
Momentary speed variation, load off and on,	
Average no load to full load,	3.0 per cent.
Average full load to no load,	2.6 per cent.
Safety speed limit operated at,	3,780 RPM.
Excess speed,	5 per cent.

Safety Speed Limits. As in all engines of high speed, some form of safety stop is desirable to check the speed should the turbine governor become inoperative through neglect or damage. Figure 11, which is self-explanatory, illustrates a well proven design of the centrifugal type. Positive action is secured by mounting the stop directly on the end of the turbine shaft, thus avoiding belts and gears. The tension of the plunger spring is adjusted by a guide bushing. As soon as predetermined over-speed is reached, usually about seven per cent., the projecting plunger trips a small valve which releases a quick closing throttle in the steam line. Once set, this speed limit cannot change adjustment, and it is only necessary to trip the throttle by hand occasionally to keep it free and in good working order.

Bearings and Lubrication. From the standpoint of reliability, this detail of the turbine is of grave concern to the operator. In the Westinghouse design two principles are rigidly adhered to: First. — Bearings of ample proportion to carry weight of rotor without resort to forced lubrication. Second. — Continuity of oil supply dependent only upon the turbine itself and not

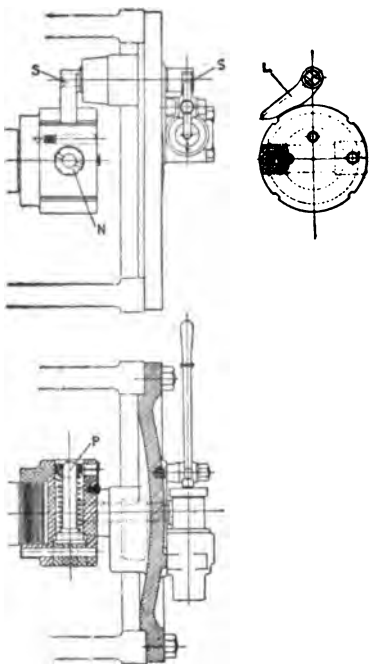


FIGURE 11. — SPEED LIMIT GOVERNOR.

upon independent auxiliaries. In spite of protestation to the contrary, past experience has proven that we must not allow the least outside interference with the integrity of the lubricating system: in other words, turbine and oil pump must run together. These principles can best be embodied in a horizontal design of turbine, and past experience has fully justified the attitude of Parsons turbine designers. Third — The oil pump of the simple plunger type is driven directly from the turbine shaft by a worm gear. Hence, so long as the turbine runs, the bearings will receive oil. Fourth. — No forced lubrication is employed, simply a static head of one or two feet, from the reservoir shown at the extreme right, Figure 4. This head is just sufficient to thoroughly flush the bearings.

Figure 12 shows a type of bearing used on all machines above 1,800 revolutions per minute, consisting of three concen-

tric, loose fitting, bronze sleeves, designed to permit the rotor to revolve about its true centre of mass instead of its geometric centre. This effectively dampens all vibration which might occur at starting. The cushioning effect is due entirely to capillary oil films between the shells. In larger turbines running at slower speeds, a simple, self-aligning, babbitted bearing is employed, as in standard, low-speed machinery. All Westinghouse turbine bearings are, however, so liberally proportioned that the shaft floats on an oil film with absolutely no mechanical contact, and this without resorting to forced lubrication.

FIGURE 12. — BEARINGS.

The returns from the bearings are piped to a strainer and cooling coils before being again pumped to the reservoir. This strainer may be by-passed for a short time to permit cleaning while the turbine is in operation, but, as there is little opportunity for dirt and foreign matter to get into the

oiling system, this is an unusual occurrence. In the oil cooler, Figure 13, the pipe coil is arranged in the form of a nest of twelve or more sections. These are connected in series and can be removed independently in case of a fault in one of the sections. In this cooler, oil circulates through the pipes with the water outside, and sufficient velocity is maintained to prevent the deposit of impurities. Furthermore, the warmest oil comes first in contact with the coldest water, a condition of maximum efficiency in cooling systems.

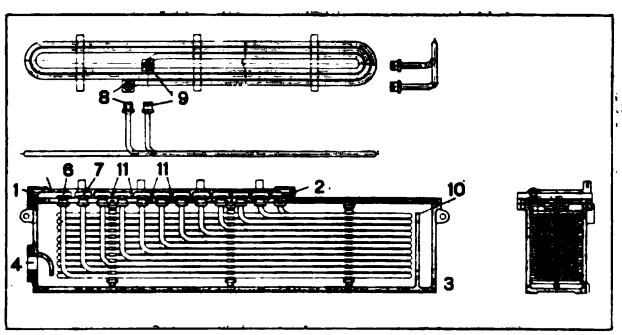


FIGURE 13.—OIL COOLER.

The bearing and lubrication system of this turbine is the result of an elaborate series of experimental tests on various lubricants and metals conducted for several years on full-sized models suited to a machine of 10,000 kilowatts capacity. The bearing tests were in each case carried out to a point of failure, and the results indicated a large margin of safety in the present bearing proportions.

It is a well-known fact that, even after several years' service, the original tool marks may be found on these bearings, which speaks for itself. It has never been found necessary to fit removable sleeves to the shafts of Westinghouse-Parsons turbines in order to localize the damage due to bearing failure.

Water Glands. For the maintenance of good vacuum, some form of good shaft packing is absolutely necessary to prevent

FIGURE 14.—WATER GLAND RUNNER

air leakage. For this purpose a mechanical packing has proven unsuitable, and in a certain type of packing largely used at present, the air leakage at light loads is so excessive as to vitiate the vacuum one or two inches. Figure 14 illustrates a type of packing gland which absolutely prevents air or steam leakage. Upon the shaft is mounted a gland runner or paddle wheel, which runs in a circular recess shown at the ends of the casing in Figure 5. A small stream of water is admitted to the centre of this propeller, which, when running, forces the water to the outside and maintains a perfect water-seal The corrugations on either side of the propeller are of assistance at the start to confine the gland water until the turbine has been brought up to full speed. In this gland the clearances are radial so as to permit a considerable amount of shaft movement.

Generator Coupling. A small, but important detail is shown in Figure 15, illustrating a standard generator coupling partly dismantled. The actual bearing surfaces through which torque

is transmitted, may be seen at the ends of the outer sleeve. The part at the extreme left, shown disengaged from the coupling sleeve, is forced and keyed on to the turbine shaft; a similar part on the generator shaft. Thus torque is transmitted through eight radial surfaces at each end of the coupling, which provides all the flexibility desired in direct connected machines having more than two bearings. This coupling is divided at the centre, as shown, in order to permit turbine spindle to be removed independently.

FIGURE 15.—GENERATOR COUPLING.

Turbo Generators. In the direct connected turbo generator may be found the most important factor limiting the general design of the turbine itself. At standard frequencies, the number of running speeds possible is reduced to comparatively narrow limits, viz., 3,600, 1,800, 1,200 and 900 revolutions per minute for 60-cycle service and 3,000, 1,500, and 750 revolutions per minute for 25-cycle service. Fortunately, the turbo generator design permits of high running speeds without incurring disadvantages in loss and mechanical strength.

Outside of its small dimensions, the turbo generator follows the standard design of alternating current apparatus, so that we need consider but two points. First. The rotating field in the

smaller sizes consists of a solid cylinder of steel with copper strap windings imbedded therein, so that the field presents a smooth cylindrical surface which greatly reduces the loss from air friction. The ends of the field are capped by non-magnetic material into which the end of the field shafts are forced under hydraulic pressure. Second. The ventilation of the generator is mechanically provided for by means of ventilating fans mounted upon the field shaft, as shown in Figures 4 and 16. Here one-half of the air chamber fitted to each end of the generator has been removed to show the fan and winding.

Air ducts beneath the turbine communicate with these fans and it is well to note here that whatever the temperature of the engine room, the generator is always supplied with a positive draft of pure, cold air from the outside. This positive ventilation is, perhaps, the most important feature of the Westinghouse turbo generator and is responsible for the high over-load capacity shown by this machine. For example, during a serious accident occurring last year at the Waterside station of the New York Edison Company, a 7,500 kilowatt Westinghouse-Parsons turbine sustained practically the entire 60-cycle load, of from 13,000 to 14,000 kilowatts for one hour and twenty minutes. This corresponds to an overload of practically 80 per cent., while the machine is usually guaranteed to sustain 50 per cent. overload for one hour.

Turbine Testing. The policy of thoroughly testing out each prime mover before leaving the builders works, has been rigidly adhered to. In the case of large turbines, a boiler plant sufficient to maintain 50 per cent. overload on the 10,000 kilowatt machines would evidently be out of the question. Up to 5,000 or 6,000 horse power capacity, however, every turbine is tested under approximately the same conditions as would obtain in practice. For this purpose, surface condenser equipments are maintained, the condensed steam being measured by actual weight. Independently fired superheaters similarly provide any desired temperature of steam supply. A typical view of a turbine arranged for test is shown in Figure 17. Here power

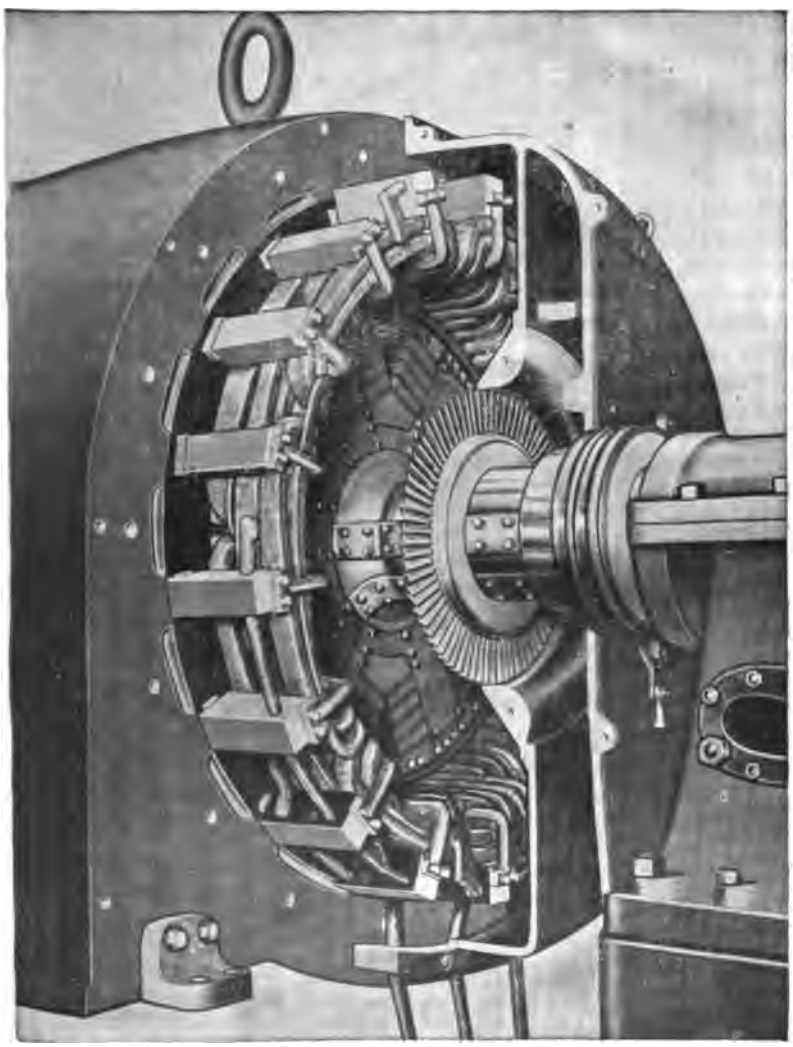


FIGURE 16.—GENERATOR END BELL REMOVED.

is absorbed by a rotary water friction brake mounted in place of the generator and operated precisely as the ordinary prony brake. The machines are first run under load to adjust the governor and determine the speed regulation, after which economy tests are conducted under various loads stipulated by contract. These are run in the presence and under the supervision of the purchaser, or his representative. Every machine must show results within the guarantees before final inspection for shipment.

In adhering to this individual testing, Westinghouse practise may be considered as standing alone. Efficiency tests involve considerable time, expense and plant investment, yet the builders have considered themselves well paid in the knowledge that every machine shipped has conformed to the necessary specifications. Other builders rely upon the chance of the purchaser running his own tests. In the great majority of cases, this is never done, aud even if so-called tests are made, there is usually room for discussion, owing to the scant facilities for carrying out such work. Great stress is often laid upon the value of a test in which power is measured entirely at the generator terminals. A moment's reflection, however, will prove the fallacy of this and reveal the simple fact that the vertical turbine cannot be readily tested by itself. Modern generator practice is so thoroughly standardized and the variation in generator efficiences is confined within such a small limit that the only uncertainty involved is the efficiency of the turbine. Moreover, with the present rate of turbine manufacture, electrical tests would be practically prohibitive, owing to the time involved in the setting up and providing a load for the generator, whereas brake tests can readily be made with the necessary facility and precision.

A typical test log is illustrated in Figure 18, covering all necessary observations on pressure, temperature, vacuum, quality of steam, speed and power. This test involves five observers with readings at five-minute intervals. As to the character of results obtained, the curves show in Figure 19 would best

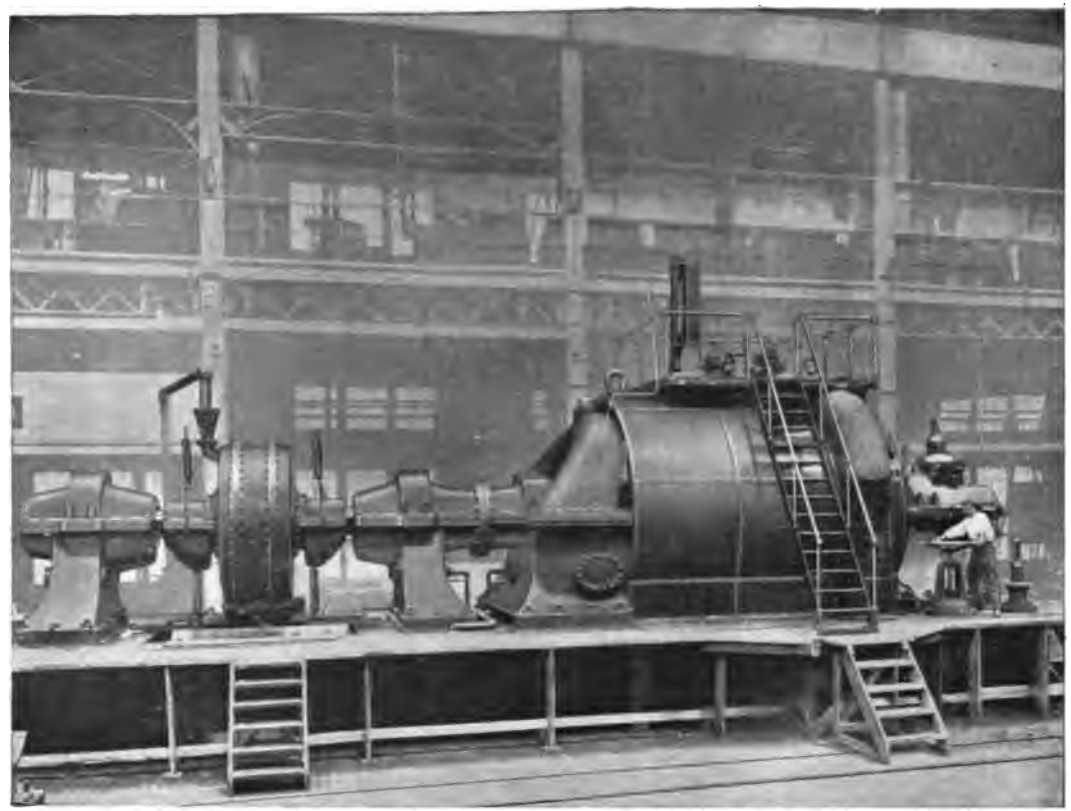


FIGURE 17.—TURBINE ON TEST.

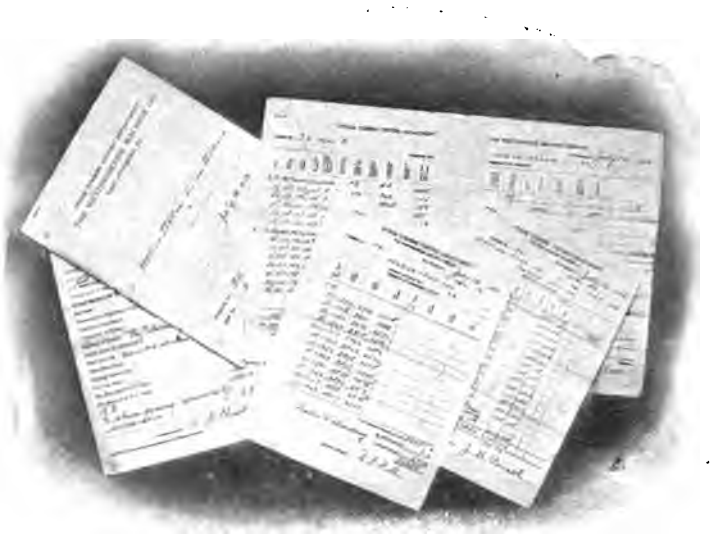


FIGURE 18.—LOG OF TEST.

indicate the general results. The turbine (a standard 1,000 horse power machine) was tested under saturated and superheated steam, non-condensing and condensing, and over a range of load from 25 to 200 per cent. of rating. Note in the change of curvature of total water line, the effect of the overload or secondary valve. When this valve has come fairly into action, the efficiency of working, although slightly decreasing at first, undergoes gradual improvement with heavier loading, as shown by the reversal of the water rate curves. Here we have a machine working from one half load to twice full load, with a variation in steam consumption of but 1.5 pounds per brake horse power hour, a little over 10 per cent. Although designed for condensing service, the machine developed when running non-condensing a brake horse power on 28 pounds of satuated steam, or 22.8 pounds with steam superheated 100 degrees F.

Without discussing this economy further, suffice it to say that the Westinghouse-Parsons turbine today holds the record in this

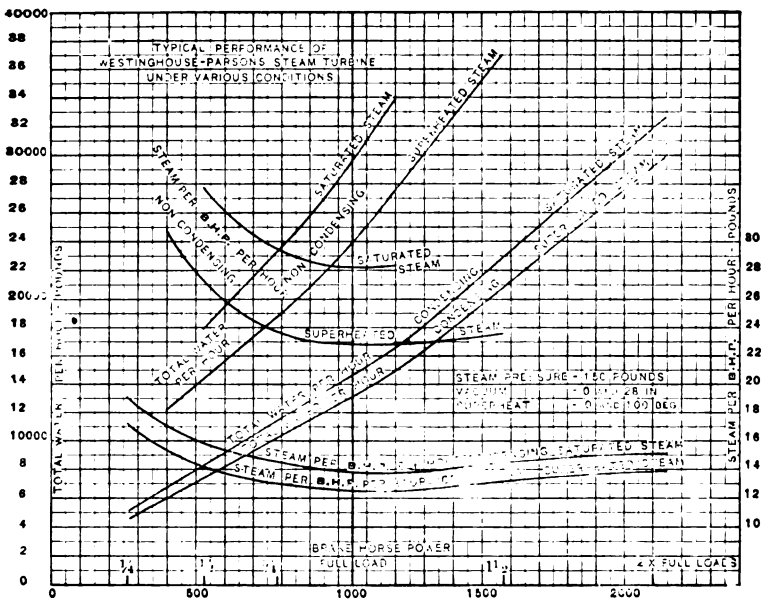


FIGURE 19. — ECONOMY CURVES.

country for efficiency when operating under conditions for which the machine was designed. Under 177 pounds pressure, 96 degrees superheat and 27.3 inches vacuum, one of these turbines has given a water rate of 14.72 pounds per kilowatt hour for two consecutive hours. This is equivalent to a little over 10 pounds per brake horse power hour, or between 9 and 9.5 pounds per indicated horse power hour, assuming a mechanical efficiency of 90 per cent., and this under very reasonable operating conditions.

In more or less confirmation of the above economies, Table 2 will be of interest.

Table II.

ECONOMY TESTS.

500 K.W. Westinghouse, Parsons Turbine, No. 209.
From tests by Messrs. Ludwig & Co., Engineers, Atlanta.
Test No. (1 hour each).

	1	2	3	5	6	4	7
Nominal load,	½	¾	full	full	full	1½	full
Conditions.		Saturated		Supht.		Low Vacuum.	
Actual load h. p.,	396	584	762	764	723	1,146	679
Steam pressure,	151	153	153	153	149	143	149
Moisture % or Supht. °F.,	.53	.50	.55	105°	.47	.42	.27
Absolute Vacuum inches,	28.0	28.0	27.7	28.0	26.0	26.3	24.1

Steam consumption: —

(A) lbs. per brake horse power hour, 14.92, 14.05, 13.68, 12.22, 14.91, 15.08, 15.86.

Steam consumption: —

(B) Guaranteed, 15.7, 14.8, 14.8, 12.7, at 150° Superheat
Better than guarantee % 5.5, 5.1, 6.08.

(A) Uncorrected for moisture.
(B) Corrected for low vacuum on full load test.

This gives results of the previously mentioned 500 kilowatt turbine tested under various conditions. Note that these results are uncorrected for moisture in the steam and especially the good results on low vacuum and the safe amount by which it bettered the contract guarantee.

Test on Mill Plant. Quite recently results of a commercial test upon an actual cotton mill installation were obtained and are presented in Table 3. The coal was of good quality, but contained a large percentage of moisture, as it was hauled during a rain storm. No allowance has been made in the weights for this moisture. The condensed steam was measured by meter and checked by weighing. Considering such a small plant running at less than two-thirds rating, a steam consump-

tion of 25 pounds per kilowatt hour, or 2.5 pounds of coal per kilowatt hour, including auxiliaries, is good economy, and especially when the small opportunity for variable economy in the turbine is considered.

Table No. III.

TEST OF COTTON MILL TURBINE PLANT.

500 K.W. Westinghouse Parsons Turbine.

Duration of Test 6.30 A. M., 6 P. M., 11 hr. 30 m.

Kind of coal (weighed and fired wet) New River, Bituminous.

Steam pressure (160 pounds start).	170 pounds.
Vacuum (ref. 30″ bar)	27.5
Net weight water to boiler,	88,351.2 pounds.
Total weight coal,	8,910 pounds.
Average evaporation per pound of coal,	9,916 pounds.
Weight of Ash recovered,	532 pounds.
Average evaporation per pound combustible,	10.54 pounds.
Output of plant,	3,600 kw. hours.
Average load,	313 kw.
Per cent. of full load rating on plant,	63 per cent.
Steam consumption per kw. hour,	24.56 pounds.
Coal consumption (as fired),	2.47 pounds.

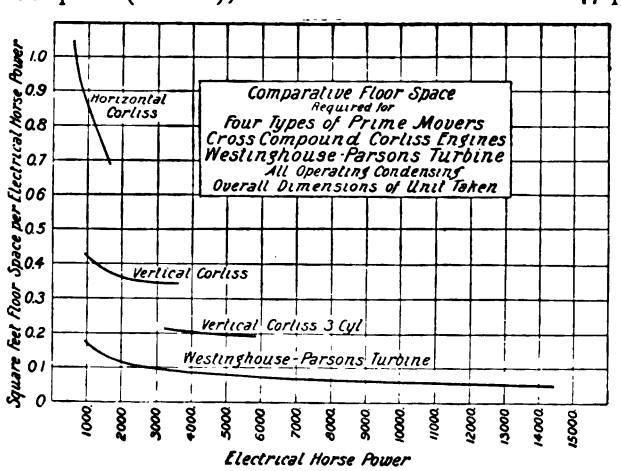


FIGURE 20. — COMPARATIVE FLOOR SPACE.

Summary. Before closing the subject, it would be well to take a general survey of the turbine situation as outlined above in detail, keeping prominently in mind the three important factors selected at the outset as the basis of our inquiry, and the advantages of this type of prime mover for textile work.

First, we have a machine that is entirely self-contained, and whose operation is not continually jeopardized by the danger of injury to independent auxiliaries.

Second, one that may be dismantled and re-assembled for service within an hour; in which only the covers of bearings and cylinder need be removed in order to lift out the entire rotor, instead of going through the laborious process of dismantling piece by piece a built-up structure.

Third, a natural force, capillary attraction, supports the rotor weight without forced lubrication or wear; not an artificial means in which the turbine has no control over its supply of oil, and only a few moments intervene between success and failure. Only this has made it possible for a Parsons turbine to run 17,200 hours without stopping.

Fourth, a generator protected from heat radiated from a turbine, steam leakage from glands, oil drip from bearings and variation in room temperature; one that is noiseless in operation and positive in ventilation, all of which insure long life.

Fifth, a system of steam distribution in which the mechanical difficulties of high velocity have been overcome by simple, subdivided expansion, entirely avoiding wear on moving or stationary blades; with a blade construction possessing ample resistance to stress and chemical action, yet capable of relieving locally any emergency condition arising from excessive temperature strains or other causes.

Sixth, we have a prime mover sensitive in speed variation to an unprecedented degree, one per cent. or less within normal ranges of cotton mill load, which insures a maximum production and always under the instantaneous control of the governor, not controlled in successive steps, requiring the turbine to "straddle" the load, as it were.

Seventh, by the addition of a single valve, we have provided enormous forcing capacity entirely beyond the range of a belt or rope drive, which will enable us to "pull through" what would otherwise constitute a serious emergency.

Eighth, once proven in shop economy tests, we have a standard for future comparison; with adjustments locked in normal working position, the economy should remain unchanged except through actual damage; and with the economies of small units so close to those of larger ones, it is possible to sub-divide power into several units a most valuable security against manufacturing interruptions.

Ninth, with the extreme compactness indicated by the accompanying curve, Figure 20, we have reduced not only floor space and head room, but also general construction costs and fixed charges thereon. This offers a very attractive feature in that turbines may frequently be used in existing power houses to care for an increased demand for power. I have in mind a cotton mill where a 1500 kilowatt turbine unit has been erected on one-half of existing foundation of a 1200 horse power cross compound engine, there being sufficient space left to erect another unit of a similar size, giving a total of 4000 horse power capacity on a foundation formerly required for 1200 horse power. Condensers, either surface or jet, are being installed beneath the turbine in the foundation, thus eliminating all bends in the exhaust piping and extra space for auxiliaries. In the Fort Wayne Central Station, turbines are located on the second floor of the power house, supported only by latticed columns.

Tenth, and finally, the whole subject of the comparative advantages or disadvantages of the steam turbine is well brought home by this fact: that two 500 kilowatt turbine units were put in operation at the power house of the Cleveland Electric Illuminating Company, 74½ hours and 47½ hours, respespectively, from the time the machines left the shops at East Pittsburg. The last machine was actually erected in 13 hours straight work.

It is hoped that the above features will serve in a measure to

explain the construction and operation of the Westinghouse, Parsons Turbine Unit, and also indicate the advantages accruing from the use of this type of prime mover, as applied to the textile industry.

The PRESIDENT. Does anyone wish to ask any questions? I am sure Mr. MERRILL will be very glad to answer anything that comes within the scope of his paper if he can.

[There were no questions.]

REPORT OF COMMITTEE ON NOMINATIONS.

The PRESIDENT. I understand that the chairman of the committee on nominations is absent and I will ask the Secretary to read his report.

The SECRETARY. Mr. J. R. MONTGOMERY, the chairman of the committee on nominations, gave me the report, which is as follows:

To the National Association of Cotton Manufacturers:

The committee on nominations have attended to the duty assigned them and report the following nominations:

PRESIDENT.

CHARLES T. PLUNKETT, ADAMS, MASS.

VICE PRESIDENT.

GEORGE OTIS DRAPER, HOPEDALE, MASS.
FRANKLIN W. HOBBS, BOSTON, MASS.

DIRECTORS FOR THREE YEARS.

ROBERT BEATTY, PHILADELPHIA, PA.
FREDERICK A. FLATHER, LOWELL, MASS.
JOSEPH MERRIAM, MIDDLETOWN, CONN.

DIRECTOR FOR ONE YEAR.

DAVID S. JOHNSTON, COHOES, N. Y.

Respectfully submitted,

J. R. MONTGOMERY,
Chairman for the Committee.

On motion of Mr. CHARLES H. FISH, the report was accepted and the committee discharged.

The President appointed as tellers to collect and count the ballots for officers Mr. W. W. CROSBY and Mr. JOSEPH P. BATTLES.

The committee having attended to the discharge of their duties and the ballot being declared closed, the reading of papers was resumed.

The PRESIDENT. The next paper is on "What a Manufacturer Should Know About Coal," by Mr. E. G. BAILEY, Chief of the Coal Department of the ARTHUR D. LITTLE Laboratory, Boston.

SOME THINGS A MANUFACTURER SHOULD KNOW ABOUT COAL.

E. G. Bailey, Arthur D. Little Laboratory, Boston, Mass.

The majority of manufacturers are dependent upon the combustion of coal for the operation of their mill. The man who is responsible for the continuous and economic operation of the plant should know: (*a*) Where he can always get coal when he needs it. (*b*) Where he can get coal of such character and quality that his plant will not be crippled for lack of steam. (*c*) What coal is the most economical for him to burn. (*d*) How to convert a large percentage of the heat energy of the coal into useful work.

(*a*) It is an exceptional circumstance when a manufacturer does not have many kinds of coal offered him at competitive prices. But at times of strikes or delays in transportation he is sometimes compelled to seek coal and pay whatever price is asked. In placing a contract this point should be kept in mind and whenever the difference in price is not too great, preference should be given to the company that is most able to keep you supplied with coal at such exceptional times. If you expect fair treatment from the coal company you must treat it fairly by living up to your part of the contract whether the price falls or rises during the continuance of the contract.

When plants are at any great distance from the mines it becomes necessary to store a considerable quantity of coal. This involves additional expense due to the extra handling, value of storage space, and loss of coal both mechanically and chemically. The loss due to oxidation or weathering of coal

not only reduces the calorific value of the coal but as the temperature of the pile rises, the oxidation becomes more rapid until the ignition temperature is reached and much additional labor and expense is necessary to prevent the burning of the coal and often the destruction of other property. There are many theories as to the cause of spontaneous combustion in coal piles and several remedies have been tried with more or less success. Storing coal under water seems to be the only method of absolute prevention. Sulphur is generally referred to as the cause of spontaneous combustion, but each per cent. of sulphur if burned completely and no heat was radiated from the pile during the slow combustion, would raise the temperature of the pile only 200 degrees Fahrenheit. Many cases of spontaneous combustion occur in piles of coal that contain less than one per cent. of sulphur, and analyses of coal from heated piles show that only a small percentage of the sulphur has been oxidized. Some heat must be radiated from the pile and a temperature considerably above 200 degrees Fahrenheit, is necessarily reached. Should the sulphur exist in the form of pyrites and both the iron and sulphur oxidize, the heat generated would not be great enough to cause the temperature of the pile to rise as high as 550 to 600 degrees, which temperatures have been reached before the coal really ignited. Excessive moisture may play some part in causing spontaneous combustion, but exceptions to this are many. The height to which the coal is piled is generally considered a very important factor, but frequently the hottest part of a pile twenty feet deep is within three feet of the surface. In one case a pile of coal ten feet deep took fire about six feet below the surface and in another part of the same pile the coal was thirty-five feet deep with no signs whatever of heating. Some coals store better than others, the reason for which seems to depend upon its physical structure rather than the chemical composition.

It seems that the rate of circulation of air through a coal pile has more to do with this question than any other condition outside of the character of the coal. The heating is mostly very

irregular throughout a pile, as there are usually spots where the temperature is much higher than in the surrounding space. For this reason the usual method of taking temperature measurements in a pile by letting a thermometer down a set of pipes scattered throughout the pile is very unsatisfactory as the hottest spot that will soon cause trouble may be missed entirely. The question, what is the safe limit for the temperature of a coal pile, is frequently asked, and it is rather difficult to answer for a coal pile may heat up to a pretty high degree, then cool down without being moved. But if there is enough heat generated to raise the temperature of the coal pile to 212 degrees Fahrenheit, the moisure being evaporated at or before this temperature is reached leaves only the dry coal, which has a comparatively low specific heat, to be heated. The heating takes place much faster and the rate of oxidation also increases with the rise in temperature. The carbon in the coal evidently oxidizes to a considerable extent as large percentages of carbon dioxide have been found in coal piles at comparatively low temperatures.

(*b*) Many plants are so limited in boiler capacity, have such poor draft, or some kind of grate or stoker that it is possible for their boiler room force to keep steam with only certain kinds of coal. While this is not an ideal state of affairs it is a condition that exists in a large percentage of the power plants in this country and unless a man knows what coal will develop the required boiler horse power in his plant he may have the costly experience of shutting down a part or all of his mill. There is a great deal of difference in the rate of combustion of different coals. The percentage of volatile matter, coking properties, amount and nature of ash are the principal factors upon which depends this characteristic in various coals. It is not always the better or higher priced coals that give the best satisfaction under such conditions, for a cheaper coal might give more satisfactory results than are being obtained with the highest priced coal on the market, but the risk of experimenting has seemed too great for the management to consider stepping out of the well beaten path.

(*c*) All minerals or raw material are bought because they contain some one ingredient or property that may by a certain treatment or operation be enhanced in value or utilized by the manufacturer in such a way as to cause him to make a profit from the principal product of his factory. It is seldom that any mineral or raw material does not contain some impurity or inert matter that may involve additional expense for its riddance or by a certain process may be converted into a by-product and thus become a secondary source of profit. Coal varies more in character and quality than any other mineral produced. In character it is found in all successive stages between lignite and anthracite. Each different kind is more applicable for one purpose than another. In selecting a coal for making illuminating gas the yield of gas measured in "candle feet" is of primary importance, while the coke and tar are by-products, and sulphur is the impurity that causes additional expense. For making coke the purity, structure and yield of coke are the properties to be considered, and the gas, tar and ammonia may be utilized as by-products. In buying steam coal the amount of heat that may be developed from it is the measure of its value to you. There is no by-product that may be utilized, except that in some cases the sale of ashes might be considered in this connection, but their removal is generally an additional expense. Two coals at the same price and containing the same number of heat units may not be equally desirable. The difference in volatile matter might cause the lower to prove more satisfactory under certain conditions of smoke restriction, while the higher volatile coal would probably be more applicable in a plant with fluctuating load. The amount and nature of ash in regard to the formation of clinker often needs to be considered.

The liability of spontaneous combustion of one coal more than another may make it advisable to pay several cents per ton more for one coal containing no more heat units than the other.

The following table shows the analyses and results of evaporative tests of some of the better coals together with their price

f. o. b. cars at the plant of an inland New England mill. The relative values have been calculated by taking coal A as a basis and determining what will be the cost of the equivalent amount of coal required to produce the same number of heat units as coal A produces for $4.60 per ton. For example, should you buy coal F at $4.40 per ton your coal bill would amount to the same as if you had bought coal A and paid $4.92 per ton for it, but as you can get coal A for $4.60 you would save 32 cents per ton by taking coal A instead of coal F at the given prices.

Coal	Moisture	Volatile	Fixed Carbon	Ash	Sulphur	B. t. u.	Lbs. water evaporated from and at 212° F	Price f. o. b. plant	Relative Cost per ton with Coal A as basis.	
									By B. t. u.	By evaporation
A	1.25	17.94	73.15	7.66	2.07	14354	9.93	$4.60	$4.60	$4.60
B	1.43	17.59	71.58	9.40	1.09	14032	9.73	4.55	4.65	4.64
C	1.17	30.51	61.01	7.31	0.99	14251	9.79	4.65	4.69	4.71
D	1.36	16.42	71.35	10.87	1.77	13811	9.60	4.58	4.76	4.74
E	1.75	19.58	71.95	6.72	0.82	14533	10.03	4.86	4.80	4.79
F	3.72	21.06	66.90	8.32	1.36	12834	8.80	4.40	4.92	4.96
G	1.74	31.16	53.69	13.42	2.93	12833	8.67	4.60	5.14	5.27

In this case it appears that neither the best nor the lowest priced coal would be the cheapest to buy.

In this table the coals are arranged in order of cost for equal amounts of heat generated and equal evaporation, but in selecting a coal for any particular plant it might be policy to select a coal that would cost a little more money in order to obtain some particular advantage that a certain coal might have over another. Comparing coals A and B, coal A appears to be better in every way except that it contains about one per cent. more sulphur than does B. For steam purposes the sulphur is of little importance below two per cent. at least, so that coal A would probably be selected on account of its being five cents per ton cheaper on a heat unit basis and there would also be less ash to handle. In case a plant had limited draft and boiler capacity a coal like C might be selected in preference to B or even A with

a difference of nine cents per ton in favor of coal A. Should the prevention of smoke be an item of considerable importance coal D would probably be purchased at an additional expense of seven cents per ton as compared with coal C. Of the two coals D and E there is a difference of only four cents per ton, and that would scarcely pay for the additional cost of handling ashes, the possibility of not being able to carry the load without the use of more boilers, and other expenses that are greater with a poorer coal.

While coal E is the best all round coal it would not pay to purchase it when coal A could be obtained for 20 cents per ton cheaper on a heat unit basis, and 19 cents per ton cheaper on an evaporation basis.

Coals F and G are both much inferior to the others and their purchase would not be considered when any of the other coals were avilable at the given prices. Judging from the ash and sulphur alone it would seem that coal F would be better that either B or D, but a certain characteristic appears in this coal that makes it different from any of the others. It is "crop" or "red" coal coming from a part of the seam near the outcrop, and has become saturated with the surface water that has been percolating through it for hundreds of years. The moisture is much higher than in any of the other coals and it contains a still larger percentage of combined water that is not driven off by the mere drying of the coal. If a man were depending upon the ash determiniation alone he would never detect that he was receiving an inferior quality of coal; in comparison with coal A he would be paying 20 cents per ton less for the coal yet he would have to burn so much more of it to develop the same horse power that he would actually be losing 32 cents per ton, or $16,000 per year on a 50,000 ton contract.

Coal G is high in ash and sulphur and correspondiugly low in B. t. u., so that it would be a very expensive fuel to burn at the price quoted, and in comparison with the other coal you would not consider it. Yet there are thousands of tons of it being burned and the manufacturer seems to be willing to pay the price.

In the preceding table the equivalent evaporation in pounds of water from and at 212 degrees Fahrenheit is given as determined in carefully conducted boiler tests on the same boiler. They represent the average of two or more tests under as nearly identical conditions as it is possible to maintain, thus accounting for the closeness of their comparison with the B. t. u. determination. Duplicate boiler tests on the same coal frequently vary five to ten per cent. even though the method of firing and the rate of combustisn have changed as little as possible. The chemical analysis and calorimetric determination will represent the value of coal within one per cent. providing the samples are properly taken. The plea for evaporative tests because they are practical is counterbalanced by their failure to burn the coal under equally comparable conditions in two or more cases. A fireman must become accustomed to different coals and find wherein they must be handled differently in the firebox in order to obtain the best evaporation from each. The laboratory tests are generally considered as theoretical and unreliable. But theory and practice always agree when they both represent the facts.

After the most economical coal has been selected, it remains for the manufacturer to see that such coal is delivered. Throughout the year the coal company may send coal of different quality from other mines, or the quality of the coal from the same mine may change, due to impurities encountered in the seam or lack of preparation at the mine. The coal operator may know of the change in quality as many of them follow up their product by chemical analysis and inspection much more closely than does the purchaser, but it is the manufacturer's place to know what he is getting and prove to the coal company that the coal has changed and that he is not receiving the coal he is entitled to by the contract. The results of an evaporative test mean but little to anyone except the man who conducts them, and apply only to the one plant and set of conditions under which they were made, while the analysis of coal is now on such a standard basis that the results are comparable whether the

sample is taken at the mines, en route, or at the destination. There are many analyses published and given out by a large number of coal companies that represent selected samples of the coal from certain parts of the seam that are absolutely valueless as representing the quality of coal actually loaded at their tipple. Such a policy is short sighted and is fortunately disappearing, for the consumer is going to find out for himself when the coal reaches his plant, and the comparison of results is generally to the discredit of the coal company. But the person who has suffered the most from this practice is the coal man who does give representative figures, for he is judged by the consumer as also giving fancy results and allowance is wrongly made for shrinkage. The present-day tendency is to buy coal on a B. t. u. basis, adjusting the price for the coal delivered in accordance with its quality. The advisability of carrying this into effect depends upon the tonnage, method of delivery, and difficulty in otherwise obtaining a uniform product. The fact that a coal company knows their coal is being systematically analyzed is generally sufficient to ensure the delivery of coal of uniform quality.

In addition to knowing what is the most economical coal to buy, the manufacturer must know —

(*d*) How to convert a large percentage of the heat energy of the coal into useful work. The efficiency of a boiler plant depends primarily upon the completeness of combustion of the fuel and completeness of absorption of the generated heat by the water or steam in the economizer, boiler or superheater. It is impossible to generate into available form all of the heat energy of the coal. Some coal and carbon are lost with the ashes, while combustible gases and carbon in the form of smoke usually escape unburned to a greater or less extent. The loss due to incomplete combustion depends largely upon the design of the grate, furnace, and combustion chamber, as well as the proportionate rate and method of supplying coal and air to the furnace.

There are so many kinds of mechanical stokers, special furnace

designs, fuel saving devices and smoke preventers on the market that the manufacturer is at a loss to know which one would give the best results in his plant or whether it would pay at all to change from the old hand fired stationary grate. Many people install a certain appliance because it has given satisfaction in some plant known to them. They do not stop to consider that their conditions may be different, they may have a more fluctuating load, it may not do equally well with the coal they want to burn, or they may not have men of the necessary intelligence or experience in their boiler room to successfully operate the appliance. A mechanical stoker that does very satisfactory work when one kind of coal is being burned may fail when fed with another coal. The fault does not lie in the stoker but in the judgment of the man who tried to burn a certain coal on it under certain conditions. A man, hand firing a stationary grate also frequently fails to keep steam with one coal when he could with another. It may or may not be the fault of the fireman, but such difficulty is usually due to his unfamiliarity with the coal, and he tries to fire it in the same manner he has been accustomed to firing the coal he has previously used. If two firemen, one having always burned a good coal that formed practically no clinker, and the other a coal which clinkered badly, should both receive the same kind of coal of medium quality, one might fail to keep steam and the other would consider that it was of very good quality. In many cases it would pay to make changes in the boiler plant or add more boilers so that the most economical coal could be burned regardless of its quality, as well as to secure as nearly complete combustion as possible.

The question of smoke prevention must receive more consideration from the manufacturer in the future than it has in the past. While it may not be possible or economical to prevent the last traces of smoke, yet there are many stacks in different parts of the country that issue so little smoke that they are not at all objectionable. In most cases where other than anthracite coal is being burned the prevention of smoke has been accomplished by means of furnace design and the method of firing.

After combustion has taken place the heat of the coal appears in the form of sensible heat in the gases leaving the furnace or combustion chamber. The important problem is to cool the gases as much as possible with a minimum of boiler heating surface. In order to accomplish this the heating surface should be kept clean inside and out. Too much emphasis cannot be put on this point. Combustion is more complete with considerable excess air, but this excess air passing through the furnace reduces the temperature of the gases approaching the boiler and the temperature of the escaping gases remains about the same so that a larger percentage of the developed heat is lost up the stack. This condition might be compared with a steam engine running with low initial pressure and exhausting against a high back pressure. The amount of air excess is regulated by the intensity of draft and condition of the bed of fuel. Few firemen have ever had the opportunity of learning what was the best thickness of fire or intensity of draft under the conditions existing in their boiler plant when burning a certain kind of coal. Many people think the stronger the draft the better, but there is opportunity to save thousands of dollars every year in many plants by merely reducing the draft or better regulation of it. The installation of a damper regulator is not always the remedy for they often cause more loss than occurred when hand regulated dampers were used.

The analysis of the flue gases is the best criterion for regulating the conditions of a furnace so as to obtain nearly complete combustion with a minimum of air excess. The perfecting of automatic gas indicators and recorders will do very much toward increasing the boiler room efficiency.

No one kind of boilers or heat absorbing apparatus will give equal satisfaction in all plants. This depends upon location of plant, kind of water, uniformity of load, kind of coal, etc., and must be determined in each individual case.

It may seem unnecessary to investigate so thoroughly what would be the most economical fuel, how it can best be burned, and how the largest percentage of the heat can be converted

into useful work, but the money saved by doing so, even in the smaller plants, amounts to a surprising sum in the course of a year. The manufacturer who is too busy enlarging his mill and increasing his output to give corresponding attention to his boiler room usually regrets the mistake when all his labor is standing idle for lack of power or the coal bill becomes a disproportional percentage of his cost of operation.

The PRESIDENT. This is certainly a very interesting paper; has any one any questions to ask? I do not hear any comments.

Before calling for the report of the Committee on Ballots, I will ask for the last paper on the programme, Heating Systems for Mills, by Mr. A. G. HOSMER.

HEATING SYSTEMS FOR MILLS.

A. G. Hosmer, Clinton, Mass.

There are in general use in manufacturing buildings, three distinct types of heating systems: first, the direct, where the heat is supplied by means of pipes containing steam installed in the rooms; second, the indirect or blower system, by introducing air previously heated; and third, the hot water or forced circulation system, where the water heated in an outside heater is forced through pipes arranged much the same as those for steam, and returned to be re-heated again, thereby making a continuous circuit.

It is the writer's purpose to enumerate some of the merits and demerits of the several systems, and consider their adaptibility under the varying conditions met with in mills and factories.

Before taking up the subject however, it is well perhaps to mention the fact that while the theory is true that air will absorb heat from any source, provided the supply is warmer than itself, in order that a cold room may be warmed to a comfortable degree and kept so in heating weather, it is necessary that the temperature of the heat supply shall be much higher than the desired temperature in the room; unless the area of heating surfaces or volume of heated air (in case of an indirect system) is much larger than it is advisable to provide in the average building for use only half the year.

THE DIRECT SYSTEM.

We will first consider a plant using non-condensing engines and heating with exhaust steam wholly or partially during

running hours, and direct steam for the remainder. It is a common custom to place a light back pressure on the engines to force the exhaust through the pipes at the proper velocity to absorb all the available heat contained therein and discharge the resultant condensation at the end of the lines at quite a low temperature.

If the areas of the pipes are ample and they are not too long or complicated this method works well, but as it is often not the condition, the steam is condensed before it reaches the end of its journey, rendering it almost useless as a source of heat for a considerable part of the way. In this case we must either raise the back pressure or turn in direct steam to accomplish the desired end.

It should be borne in mind that the adding of one pound of back pressure to an engine cannot be made up by adding one pound to the initial pressure, as back pressure is the same as mean effective pressure resisting through the whole stroke, while initial pressure extends its full force only to the point of cut off.

It is quite clear that adding back pressure to an engine, especially if it is large and well loaded, should be avoided if possible. From the foregoing statements it would seem that the entire heat from exhaust steam cannot usually be utilized without running more or less back pressure on the engines and therefore cannot be forced or hurried to any extent unless disagreeable conditions are brought about in the engine room. In some instances the circulation of the exhaust is assisted by establishing a vacuum at the discharge end of system by means of a pump or fan, thus doing away with the objectionable back pressure on the engines. This is a decided advantage if the engines are large, but it necessitates the complication of piping, with the cost and running expense of some more or less elaborate system for the maintainance of the vacuum. As a rule, the method of heating by exhaust steam leaves a great deal to be desired and is not advisable unless it is necessary to use non-condensing engines.

Taking low pressure steam from the receiver of a compound

engine is a common practice in some mills. If the quantity of steam taken is fairly constant and the engine is designed with that object in view, the results are quite satisfactory, although this idea is usually more popular with the designing than the operating engineer.

It is well to remember when designing any supply of heat for the purpose of warming the buildings of a manufacturing plant that exhaust or receiver steam is available only during running hours, and that the heating system's highest duty is usually required when the engines are shut down, consequently it is more important to have an efficient service during non-running hours, than at times when machinery friction and other causes contribute to the warmth of the work rooms.

With a direct system installed and designed for the use of live or boiler steam alone, the engines are left out of the proposition, and direct steam usually reduced in pressure is sent to the heating pipes, remaining there until condensed and finally discharged through a trap to the atmosphere or to a tank to be fed back to the boilers.

With the trap working properly, nearly the same pressure is kept upon the entire length of pipes and all water automatically removed. This renders every foot of pipe equally efficient with the heat nearly uniform and due to the pressure carried.

In a building or series of buildings closely grouped and with it possible to have the drips carried to some point somewhat lower than any of the heating pipes, and not too far from the boilers, the condensation ought never to be cooler than 200 degrees, and can be pumped or trapped to them without much loss of heat.

If piping is large and well installed with separate traps for each considerable unit of circulation this will be found to be one of the most economical and satisfactory methods of heating. It can be forced or moderated within reasonable limits by raising or lowering the pressure at reducing valve, and with everything right will give return for practically all the heat expended.

The benefit of returning the condensation to the boilers is

quite often not realized in many plants fitted for so doing, for the reason that a pump designed and used for handling very hot water is one of the most difficult appliances to keep in repair that the mechanic has to deal with, consequently the tendency generally is to neglect this important feature, and as the heating can be done without it, that is, by running the water to waste, the pump is allowed to stand idle for a great part of the time. This should not be permitted, as the expense of keeping it in first class order is a small item compared with the loss of the heated condensation.

In buildings equipped with either the direct or hot water systems where no wall space is required for storage or other purposes the pipes can be placed around the sides below the windows. As warm air naturally rises, this location insures good heat distribution and comfort for the operatives.

The prevailing custom at the present time is, however, to arrange them on the ceilings where they will not be injured by passing trucks or obscured by material stored in front of them.

With the overhead location, the coils are not as liable to become repositories for brooms, clothing, waste or other refuse which might ignite and cause serious damage by fire.

THE INDIRECT OR BLOWER SYSTEM.

The efficiency of any steam heating system depends on the amount of steam condensed or relieved of its heat per square foot of surface exposed.

It is therefore clear that pipes of a given area arranged as in the fan system where cool air passes through them very rapidly, are many times more efficient than a radiating surface of the same area exposed under ordinary conditions.

The fresh air for use in this system is usually supplied from out of doors, and in heating weather is always cool enough to absorb heat from almost any source of even moderate temperature. Warm water from condensers circulated through pipes, furnace gases passing through large flues on their way from economizers to chimney (when artificial draft is employed) to-

gether with live and exhaust steam can be used successfully. Direct steam heating coils are usually located so that condensation can be returned to the boilers. Heaters using exhaust steam should be so arranged that the cool air passes through or over them in the opposite direction to the current of steam and enters at the cool or discharge end.

It is customary to arrange the fan to draw the air through the coils and force it to the various rooms.

As any blower can usually give more efficient results when placed near the air supply it would seem preferable to install it at the inlet and handle the air before it is heated.

It is important that the openings from air trunks into the rooms should be of moderate size and well distributed, and that the size and capacity of the fan and heaters should be such that the required volume of supply can be furnished at a moderate velocity without causing too much of a current. In many cases this system has not given satisfaction from the failure to give attention to the above points.

Rooms in exposed locations or on the north side of a building always require more heat than those more fortunately situated. These can be accommodated without making any change in the heating plant proper, by placing auxiliary coils in the main ducts leading to the points where extra service is required.

It is often possible to obtain very economical results with this system by using the air more than once, or taking warm air from one department where there may be a surplus of heat from the nature of the work, to a cooler department. This necessitates a return duct or by-pass back to the suction side of fan and is not feasible unless the rooms and heating plant are quite near together.

The advantages of this system are many, and for some kinds of manufacturing, particularly where a moderate heat and plenty of fresh air is needed, is perhaps the best in use. It is quite simple, and the parts requiring care are compact, with no heating pipes located where freezing is possible, or leakage can do much damage. Results can be obtained very quickly, and in many

cases the warm air need not be turned into the rooms until within a few minutes before starting time. In some parts of textile manufacture this constant changing over of the air is not desirable, having a tendency to make the rooms too dry, and unless the incoming air is moistened by some means before entering, conditions are too much dependent on the weather. In rooms filled with revolving shafting and pulleys the current set up by the fan should not be as strong as in those without machinery.

THE HOT WATER OR FORCED CIRCULATION SYSTEM.

In order to obtain satisfactory results with this system the speed of the water through the circulating pipes must be high to prevent any too sluggish movement in the shunts or isolated coils that offer a little more frictional resistance than the more direct lines, and also the temperature should not be allowed to fall very much during its passage through the entire system to secure uniform efficiency throughout. In ordinarily cool weather it should be sent out as warm as 200 degrees and returned at not less than 150 degrees.

In some plants this system has been installed with a view of utilizing the heat of the exhaust steam from condensing engines on its way to the condenser, by placing a heater between and running the engines with a vacuum more or less reduced.

As has been mentioned, the temperature of the outgoing water should be about 200 degrees, and that entering the heater 150 degrees, it is evident that to enable it to absorb any heat from the exhaust the vacuum would have to be adjusted to make the temperature of said exhaust somewhat above 150 or at least 160 degrees; this corresponds to a vacuum of about twenty inches, or five pounds absolute pressure.

At a temperature of 180 degrees we have only twelve inches, and at 200 degrees six inches, or a little less than one fourth of the usual efficiency of the condenser. The choice is offered then to either run a low vacuum and sacrifice a portion of the benefit derived from the condenser, or add live steam in a secondary heater to make up for what the low pressure steam

cannot do. For efficient results with this method of heating the water while passing through the exhaust chamber, the size of engines and capacity or requirements of the circulating system should be so proportioned that the passing water will absorb the entire amount of available heat in the exhaust steam.

To illustrate, we will suppose we are running the engines with a vacuum of twelve inches to give the exhaust a temperature of about 180 degrees, our circulating water enters the heater at 150 degrees, thus we have 30 degrees available.

If the quantity of water exposed in the heater is sufficient to absorb all the heat passing in the exhaust (that is, heat above 150 degrees) all is well, but as the temperature of this heating medium is governed wholly by the condition of the vacuum, regardless of the quantity of exhaust going by, any excess will pass through without giving up its available heat, and the impaired vacuum will have to be made up by steam from the boilers for a part of which there will be no return. In other words, we will have to add enough extra heat in form of boiler steam to raise the mean effective pressure to the point it would be with regular conditions in condenser, and to pay for this we have only what heat has been absorbed by the circulating water.

Every 2.04 inches taken from the vacuum decreases the mean effective pressure one pound. It will be remembered that back pressure or vacuum, as the condition on the discharge side of an engine piston may be called, applies to the entire length of stroke the same as mean effective pressure. It is therefore evident that the raising or lowering of this pressure, even a few pounds, on a large engine cylinder means quite a serious difference in the important work done by the condenser and the power output of the engine.

If the quantity of exhaust steam is insufficient at times, care must be taken to avoid lowering the vacuum too much, as it will spoil regulation, and complicate things generally, especially with compound engines. The line between waste and economy in this proposition is so finely drawn that to use the minimum

temperature of the exhaust with also the minimum amount of direct steam, and realize the required results, the adjustments should be watched very closely. In installations where the engines and condenser systems are not considered and direct steam used entirely, the heaters are usually placed in the boiler house enough above the water line of boilers to insure a gravity return for the condensation. Provision must of couse be made for operating the circulating pump at night and during holidays and Sundays.

In nearly all equipments of this kind a supplementary heater or section of one of the heaters is used for the exhaust from the pump engine or turbine.

As has been spoken of before, the most severe duty on the system comes when the plant is shut down, particularly early mornings. At such times the water must be used at the maximum temperature, and as the exhaust from engine is not over 210 degrees unless back pressure is made use of, the steam will pass by the water coils, transferring little or no heat to them. In places where condensing water is available, it is sometimes better to install a small condenser for the pump engine and do away with the inefficient exhaust heater.

The circulating system is sometimes connected with the economizers to use the waste heat passing to chimney during non-running hours. While the theory of this is excellent, in practice it is hardly ever desirable, for the reason that the economizers during working hours are handling water quite hot, and at a high pressure, and if cooler water at a much lower pressure is introduced it contracts the joints and produces a change in conditions which usually develops more or less serious leaks and perhaps the loss of a gasket when the high pressure is again admitted. The repairing of economizer joints is not a pleasant task, to say nothing of the trouble and expense of having the machine out of commission when needed.

This system cannot be hurried to any extent, and it is consequently advisable to avoid letting a building cool down very much during cold weather by running the circulation continually.

In this respect a direct heating system using steam has a material advantage, as it is seldom needed until a few hours before starting time and rarely through the entire day.

In case of accidents to the machinery driving the pump a bad feature presents itself, as it is necessary to use steam in the circulating pipes instead of water. This is almost sure to cause trouble if the pockets or drops in the lines are not properly drained, as the entrapped condensation will cause hammering with innumerable leaks and frequently split some large fitting.

Particular attention should be always given to installations of this kind to arrange the pipes with the same pitch and draining facilties that would be required if high pressure steam was used.

The excessive number and size of pipes required in this system is quite a detriment in plants where space on walls or ceilings is limited and lighting capacity not the best.

For a plant consisting of many buildings scattered, and at some distance from the boilers, the hot water system is admirably adapted. If the heaters are large and well installed where little or no heat can be lost by radiation, with direct steam condensation returned to boilers at little or no expense, and with a pump operated economically, nearly all the heat taken from the boilers can be made good use of and a service provided unattainable by any other means.

The first cost of the different systems varies greatly and depends somewhat upon local conditions, but usually the steam equipment is much cheaper than either the blower or hot water system.

It appears quite evident that no one system possesses all the advantages or can fulfill the requirements in every case, and that where one would be of excellent service another would fall far short of giving satisfaction.

In any plant of considerable size and devoted to many different processes, it usually occurs that in some departments or buildings one particular type is better adapted and will give much better results than any other; it seems sensible, therefore, in considering heating facilties for such a plant to abandon the idea of employing one system alone.

The consequences arising from inefficient or inadequate heating service in a textile mill, even for a few hours at a time, are too well known to need any comment, other than to emphasize the importance in any system, of having heaters, pipes, and in fact everything connected therewith of ample size and capacity, thus enabling them to meet any reasonable call for extra duty.

The PRESIDENT. Has any one any questions to ask on this paper? If not we are ready to hear the report of the Committee on Ballots.

The following report was submitted to the Secretary.

REPORT OF COMMITTEE ON ELECTION OF OFFICERS.

To The National Association of Cotton Manufacturers :

" The committee appointed to collect and count the ballots for officers for the ensuing year report that fifty ballots have been cast, all of them being for each of the following named candidates:

PRESIDENT.

CHARLES T. PLUNKETT, ADAMS, MASS.

VICE PRESIDENTS.

GEORGE OTIS DRAPER, HOPEDALE, MASS.
FRANKLIN W. HOBBS, BOSTON, MASS.

DIRECTORS FOR THREE YEARS.

ROBERT BEATTY, PHILADELPHIA, PA.
FREDERICK A. FLATHER, LOWELL, MASS.
JOSEPH MERRIAM, MIDDLETOWN, CONN.

DIRECTOR FOR ONE YEAR.

DAVID S. JOHNSTON, COHOES, N. Y.

Respectfully submitted,

W. W. CROSBY,
JOSEPH P. BATTLES.

The PRESIDENT. Gentlemen, you have heard the report of the committee; I declare these officers elected. It gives me much regret that Mr. PLUNKETT is not here to be initiated into office. I only wish to bespeak for him the same hearty co-operation that I have received both from your organization as such and from the Board of Government. I thank you for your courtesies and co-operation. If there is nothing further to be said I declare this meeting adjourned.

The meeting thereupon at 4.35 P. M. adjourned.

Attest:

C. J. H. WOODBURY,

Secretary.

INDEX.

A

Active Members, May 1, 1908 . 15
Address of Welcome to the National Association of Cotton Manufacturers, Arthur A. Noyes, April 16, 1908 119
Advertising Income 115
Africa, Cotton Cultivation in, Wm. Howarth 267
African Cotton Exportation . . 271
African Weaving 156
Air Test of any Weave Room . 437
Alphabetical List of Members May 1, 1908 14
Ames, Gen. Wm., Member Nominating Committee, April 16, 1908 98
Amendments to Charter . . . 4
Amendments to Constitution and By-laws 9
American Cotton Crop 267
American Cotton Manufacturers' Association, Programme of Greeting 186
Arbitration of Cotton, Bremen Exchange 191
Arbitration on Yarn in Europe . 291
Arnold, Charles H., Elected Active Member, April 17, 1908 . 440
Art Club, Invitation to Exhibition, April 16, 1908 93
Arts of Weaving and Spinning, Wm. B. Weeden 152
Art Museum, Boston 97
Art Museum, Invitation to, April 16, 1908 93
Associate Members, May 1, 1908 39
Association Dinner, April 16, 1908 95
Association Independent of Other Organizations 131
Association Medal 103
Association Medal and Certificate Fund, 1908 112
Association Medal, History of . 103
Association Medal, Recipients of 104
Assouan Dam 199
Atlanta Conference 195
Atlanta International Conference of Master Cotton Spinners and Manufacturers 103
Atlanta Conference, Results of . 130
Attendance, April 16 and 17, 1908 83
Atwood, Clinton W., Elected Active Member, April 17, 1908 . 440
Austria Official Conditioning House 291
Automatic Thread Tester, Moscrop 321
Auditor's Report 1908 113
'Ayer, George A., Member Committee on Association Medal, 1907 103

Ayer, Nathaniel F., Chairman Dinner Committee, April 16, 1908 91

B

Badges, April 16, 1908 92
Baer Single Thread Tester . . 319
Bailey, E. G., Resolution and Thanks to 423
Bailey, E. G., Some Things a Manufacturer Should Know About Coal 498
Baker, Joel Robert, Received Student's Medal, 1908 . . . 104
Balance, Staub's 314
Banquet, April 16, 1908, Menu . 219
Basketry, Origin of 153
Bates, Daniel Moore, Member Nominating Committee, April 16, 1908 98
Battles, Joseph P., Member Committee on Ballot for Officers . 51
Battles, Joseph P., Member Meeting Committee, April 16, 1908 92
Beatty, Robert, Chairman, Meeting Committee, April 16, 1908 92
Beatty, Robert, Chairman Committee on Student's Medal, April 16, 1908 104
Beatty, Robert, Elected Director for Three Years 518
Belts and Belt Transmission, Chas. F. Chase 446
Belts, Tanning of 447
Belts, Tight 450
Bemis, Albert Farwell, Member Dinner Committee, April 16, 1908 1
Bentley, Lewis E., Elected Active Member, April 16, 1908 . 440
Beresford, Admiral Sir Charles, Chinese trade 251
Bills Receivable, 1908 113
Birch, Arthur, Elected Associate Member, Oct. 4, 1907 . . . 279
Blades on Steam Turbines . . 470
Blower System for Heating Mills 512
Board of Government 10
Bonds of Railroads and Cotton MillsStocks,InvestmentReturn 180
Boston Art Club 97
Boston Art Club Exhibition . . 97
Boston Museum of Fine Arts . . . 97
Bradlee, Arthur T., Member Dinner Committee, April 16, 1908 91
Bremen, Congress European Federation 188
Bremen Cotton Exchange, Methods of 188
British Cotton Growing Association 269
Brown and Sharpe Yarn Balance 305
Brunswick Hotel Lunch, April 16, 1908 92
Bryan, Wm. J., on Stock Exchanges 259
Bryant, C. B., Progaamme of Greeting 186
Buckets on Steam Turbines . . 467
Bullard, W. Irving, Cotton Mill Stocks as Investments . . . 164
Bullard, W. Irving, Member Association Medal Committee, April 16, 1908 103
Burke, James A., Elected Active Member, April 17, 1908 . . 440
Burleigh, Charles B., Address Awarding Association Medal, April 16, 1908 117
Burleigh, Charles B., Chairman Association Medal Committee April 16, 1908 103
Burleigh, Charles B., Received Association Medal for 1907 . 103

C

Call to 84th Meeting 90
Cancellation of Orders 239
Capital Invested in New England Water Powers 226
Capital Represented by Association 101
Cards, Woolen and Worsted, Represented in Association . 101
Caridia, P. N., Egyptian Cotton 198
Carnegie, Andrew, Attributes of 250
Success 250
Carpenter, Prof., Belt Testing . 454
Certificates, Cotton Warehouse 192
Change of Name 4
Charter 3
Chase, Chas. F., Belts for Belt Transmission 446
Chase, Charles B., Elected Active Member, April 17, 1908 . 440
Chicago Conference on Trusts and Combinations 103
Chinese Trade, Admiral Sir Charles Beresford 251
Church, John H. C., Member Meeting Committee, April 16, 1908 92
Classification of Cotton, Bremen and New York, Cost of . . . 191
Classification of Cotton, Bremen Exchange 191
Clewes, Henry, Financial and Trade Situation and Prospects 244
Clews, Henry, Resolution and Thanks to 423
Cling Surface 452
Close Corporations 164
Coal Calorific, Value of 493
Coal, E. G. Bailey 498
Coal, Value of 493
Collins, Charles E., Elected Active Member, April 17, 1908 440
Coman, James Groesbeck, Received Student's Medal, 1908 104
Combing of Short Staple Cotton, John W. Nasmith 331
Committee on Ballot for Members, April 17, 1908 444
Committee on Student's Medal . 104
Compressing by Gin, Resolution on 422
Conditioning Cotton Yarns, Robert J. Hoguet 284
Conditioning in New York . . 292
Condition Tickets 290
Conference at Atlanta, Expenses of 114
Conference, Executive Committee of, Atlanta 102
Conference on Trusts and Combinations, Chicago 103
Conley, Thomas H., Elected Active Member, April 17, 1908 . 441
Consolidation, Steadying Power and Influence of, James Logan 136
Constitution and By-laws . . . 5
Constitutionality of Forest Reservations 226
Construction and Ventilation of a Weave Shed, Samuel M. Green 426
Continental Cotton Manufacturers' Visit of October, 1907 . . 106
Continental Cotton Trade . . . 167
Cooling Air for Weave Shed . . 434
Cost of Coal 493
Cost of Combing Waste 335
Costs, Fixed 149
Cost of Lubrication 342
Cost of Raising Sea Island Cotton 217
Cotton Crop, America 267
Cotton Consumption in New England 193
Cotton Cultivation in West Africa, Wm. Howarth . . . 267

Cotton, Egyptian, Caridia, P. N. 198
Cotton Exchange, Need and Advantages of in New England, James R. MacColl 187
Cotton Improved by Storage in the Seed 196
Cotton Mill Stocks as Investments, W. Irving Bullard . . 163
Cotton, Normal Percentage of Moisture in 285
Cotton Press, Davison 204
Cotton Raising in English Possessions 269
Cotton, Sea Island, F. G. Schell 215
Cotton, Steaming of 287
Cotton, Short Staple Combing, John W. Nasmith 331
Cotton Stocks in Liverpool . . 193
Cotton, Tare, Arkwright, Clapp Standard 189
Cotton Yarns, Conditioning of, Robert J. Hoguet 284
Count, Testing 313
Count, Testing for 297
Count, Variations in 299
Copper Printing Rolls, Treatment of 106
Couplings for Steam Turbines . 485
Cox, Thomas G., Member Meeting Committee, April 16, 1908, 92
Cramer, Herr, Vice-President Bremen Cotton Exchange . . 188
Crop of Egypt, Cotton 199
Crop of Sea Island Cotton . . . 217
Crosby, W. W., Chairman Committee on Ballot for Members, April 17, 1908 445
Crosby, W. W., Chairman Committee of Ballot for Officers . 518
Crosby, W. W., Galvanized Iron Roofing 439

D

Dacca Muslin 156
Damping Yarn 287
Dana, Phillip, Member Meeting Committee, April 16, 1908 . 92
Danker, Daniel J., Member Meeting Committee, April 16, 1908 92
Daniels, F. G., Elected Member April 17, 1908 441
Davison Cotton Press 204
Davis, John P., Elected Active Member, April 17. 1908 . . . 441
Dean, Francis W., Elected Associate Member, April 17, 1908, 443
Delano, Lloyd, Received Student's Medal, 1908 104
Density of Egyptain Cotton . . 204
Depreciation of Mill Plant . . . 177
Destruction of Forests 224
Diagrams of Thread Tests . . . 325
Dinner Committee on Banquet, April 16, 1908 220
Dinner Committee, 84th Meeting, 91
Direct Steam Heating, A. G. Hosmer 509
Divine, Bradford C., Memorial Sketch of 75
Dividends English Cotton Mills, 174
Dividends of Cotton Mills . . . 166
Dividends paid by Early Massachusetts Mills 170
Dividends Paid on Cotton Mill Stocks 168
Draper, Eben S., Lieut. Gov., Address of Welcome, April 16, 1908 124
Draper, Eben S., Resolution of Thanks to 423
Draper, George Otis, Hand Testing 330
Draper, George Otis, Member Resolutions Committee, April 16, 1908 99
Draper, George Otis, Elected Vice-President 518

Dawson, Arthur O., Member Nominating Committee, April 16, 1908 98
Draper, George Otis, On Weaving Costs 265
Draper, George Otis, Spindle Bands 461
Draper Loom, Louis Simpson, 262
Draper, Table of Hank Weights, 308
Dronsfield, Albert J., Elected Active Member, April 17, 1908, 441
Duckworth, Harry S., Elected Active Member, April 17, 1908 441
Dumaine, F. C., Hearing at Washington on Forest Reservations, 1908 132
Dwelly, Frank H., Memorial Sketch of 75

E

Earnings of Association, 1908 . 113
Eaton, Russell W., Member Nominating Committee, April 16, 1908 98
Economic Possibilities of Good Lubrication, Wm. F. Parish, Jr. 339
Education, Industrial Commission 128
Egyptian Cotton, P. N. Caridia 198
Egyptain Cotton Crop 199
Egyptian Irrigation 199
Egyptain Cotton, Varities of . . 200
Egyptain Cotton Weight of . . 204
Egyptain Weaving 154
Election of Members 440
Election of Officers, Committee of 518
Elworth, Gin Press 203
Employees as Stockholders . . 179
Engines, Steam, see Steam Turbines . . . . . .
Engine Testing Plant 354
English Cotton Manufacturers Visit of October, 1907 . . . 106
English Cotton Mill Dividends, 174
English Looms and Spindles . . 125
English Mills Dividends . . . 176
Evolution of Weaving 154
Exchange, Cotton, Need and Advantages of in New England James R. MacColl 187
Executive Committee, Atlanta . 102
Expenses of Association, 1908 . 113
Expenses of Atlanta Conference. 114
Expiration of Terms of Office . 98
Export British Cotton Goods . 252

F

Fall River Dividends 171
Fall River Mill Stock Fluctuations 173
Fan Blower for Ventilation . . . 432
Fan System for Heating Mills . 512
Farr Alpaca Co., Weave Shed . 426
Faunce, Vernon C., Elected Active Member, April 17, 1908 441
Fernley, John A., Member Meeting Committee, April 16, 1908, 92
Fernley, John A., Production of Combers 336
Financial and Trade Situation and Prospects, Henry Clews, 244
Financial Statement 116
Financing English Cotton Mills, 175
Fine Arts, Boston Museum of, Invitation April 16, 1908 . . 93
Fixed Costs 149
Firth Scholarship 105
Firth Scholarship Fund, 1908 . 112
Fish, Charles H., Recipient of Association Medal, April 16, 1908 117

Flather, Frederick A., Elected Director for Three Years . . 518
Flather, Frederick A., Elected Life Member, April 16, 1908, 105
Flemish Weaving 157
Foreign Cotton Manufacturers Visit of October, 1907 . . . 106
Forest Reserves, National, Resolution on 423
Forest Reservations, Hearing on 101
Forest Reservations, Hon. Harvey N. Shepard 224
Forestry as a Crop 226
Forestry Hearing, Washington Jan. 30, 1908 132
Fox, Thomas William, Elected Active Member, April 17, 1908 441
French Forest Cultivation . . 225
Friction Load in Mills 450
Fuller, William A., Elected Active Member, Oct. 4, 1907 . . 278
Futures 194
Futures in Trading on Bremen Exchange 189

G

Generator-couplings Steam Turbines 485
Geographical List of Members, May 1, 1908 48
Gin Press, Egyptain 203
Gin Compressing, Resolution on, 422
Ginning Egyptian Cotton . . . 202
Ginning in West Africa 274
Glazing of Saw Tooth Roof . . 430
Governors of Steam Turbines . 478
Grantham, Charles T., Elected Active Member, April 17, 1908 441
Gray, Joseph P., Elected Associate Member, April 17, 1908, 443
Great Britain Cotton Goods Export 252
Greek Weaving 155
Green, Albert H., Elected Associate Member, April 17, 1908, 443
Green, C. Singleton, Elected Active Member, April 17, 1908, 441
Grant, George P., Jr., Member of Committee on Student's Medal, April 16, 1908 . . . 104
Greene, S. Harold, Elected Active Member, April 17, 1908 441
Greene, Samuel M., Construction and Ventilation of a Weave Shed 426
Greene, Edwin Farnham, Member Resolutions Committee, April 16, 1908 99
Guests at Banquet, April 16, 1908 221
Guild, Curtis, Jr., Governor; Letter of Regret 122
Gummey, John Walter, Elected Associate Member, April 17, 1908 443
Gutters in Saw Tooth Roof . . 428

H

Hale, Frank J., Member Meeting Committee, April 16, 1908 . 92
Hamilton, Rev. Frederick W. Address at Banquet, April 16, 1908 226
Hamilton, Rev. Frederick W. Resolution of Thanks to . . 423
Hand Looms in Orient 158
Hand Looms in Russia 158
Hansen, Harvey C,, Invitation to Hippodrome 422
Hartshorne, Wm. D. President, Address, April 16, 1908 . . . 128
Hartshorne, Wm. D., Address, at Banquet, April 16, 1908 . 223

Heating System for Mills, A. G. Hosmer 509
Heating Weave Shed 432
Heilman Comber 332
Henry, A. G., Member Committee on Ballot for Members, April 17, 1908 445
Herzfeld, Technical Testing of Yarns and Fabrics 312
Hetherington Comber, ... 332
Hippodrome, Invitation to . . . 422
Hoadley, Fred M., Elected Associate Member, April 17, 1908 . 443
Hobbs, Franklin W., Elected Vice President 518
Hodges, Charles E., Elected Associate Member, April 17, 1908 443
Hoguet, Robert J., Conditioning Cotton 284
Hoguet, Robert J., On Thread Tests 329
Hoguet, Robert J., Resolution of Thanks to 423
Honorary Members May 1, 1908 14
Horton, Herbert H., Elected Active Member, April 17, 1908, 441
Hosmer, A. G., Heating Systems for Mill 509
Hot Water Heating for Mills . 514
Houghton, Henry S., Jr., Memorial Sketch of 76
Howarth, Wm., Cotton Cultivation in West Africa 267
Howarth, Wm., Resolution and Thanks to 423
Howe, Frederic W., Member Meeting Committee, April 16, 1908 92
Humidity of Air in Weave Room, 437

I

India, Transportation of Testing Instruments 349
Indian Weaving 156
Indirect Heating for Mills . . . 512
Industrial Education, Commission of 128
Industrial Stock Fluctuations . 173
Ireland, Transportation of Testing Instruments 349
Irrigation in Egypt 199
International Conference of Master Cotton Spinners and Manufacturers, Atlanta . . . 102
International Federation of Master Cotton Spinners' and Manufacturers' Association, Paris Meeting 214
International Federation Cotton Spinners and Manufacturers, Vienna Report 93
Invested Funds of Association 1908 112
Investment Returns of Railroad Bonds and Cotton Mill Stocks 180
Invoice of Foreign Cotton Yarns 292
Inviolability of Mercantile Obligations, Wm. Whitman . . . 237

J.

Jamieson, Joseph B., Member Meeting Committee, April 16, 1908 92
Japanese Hand Looms 158
Jenckes, William H., Elected Active Member, April 17, 1908 441
Johnston, David S., Elected Director for One Year . . . 518

K

Kerr, Nathaniel B., Member Association Medal Committee, April 16, 1908 103
King's Orchestra at Banquet, April 16, 1908 220
Knight, Stephen Albert, Memorial Sketch of 76

Knife Gin 202
Knitting Machines Represented in Association 101
Knowles Yarn Assorting Balance 304

L

Lagas, Exportation of African Cotton 271
Lanning, Charles D., Elected Associate Member, April 17, 1908 443
Latshaw, Stanley R., Elected Associate Member, April 17, 1908 444
Lea Tester, Mechanical 317
Lea Quadrant 303
Leather, Loading of 448
Lecocur, Pinel, Comber . . . 332
Leigh, Frederick, Depreciation, 178
Library Fund, 1908 112
Library, Request for 107
Life Members, May 1, 1908 . . 14
Life Membership Fund, 1908 . 112
Lincoln, Guy M., Elected Associate Member, April 17, 1908, 444
Lister, Alfred, Elected Active Member, April 17, 1908 . . 441
Listing of Cotton Mill Stocks . 182
Little, Arthur D., Elected Associate Member, April 17, 1908, 444
Liverpool Cotton Stocks . . . 193
Location of Membership, May 1, 1908 73
Logan, James, Resolution of Thanks to 423
Logan, James, Steadying Power and Influence of Consolidation, 136
Loom, Draper, Louis Simpson . 262
Looms and Spindles in England, 125
Lowe, Arthur H., Hearing at Washington on Forest Reservation, 1908 132
Lowe, Stephen C., on Combers, 337
Lowe, Stephen C., Reading Paper on Nasmith Comber . 331
Lubrication, Economic Possibilities of, Wm. F. Parish, Jr. . 339
Lyall, Wm. L., Secretary Committee on Resolutions, Report of 423
Lyall, Wm. L., Member Resolutions Committee, April 16, 1908 99
Lyle, J. Irvine, Elected Associate Member, April 17, 1908, 444
Lyon, Allen S., Memorial Sketch of 78

M

Macaya, Sr., D. Roman, Elected Active Member, April 17, 1908, 442
MacColl, James R., Chairman Committee on Resolutions, April 16, 1908 98
MacColl, James R., Report of Committee on Resolutions . 423
MacColl, James R., Moisture in Cotton 285
MacColl, James R., Need and Advantages of a Cotton Exchange in New England . . 187
MacManus, John, Elected Active Member, April 17, 1908 . . . 442
Main, Charles T., Member Association Medal Committee, April 16, 1908 103
Main, Charles T., Member Committee on Association Medal, 1907 103
Manchester Chamber of Commerce Conditioning House . 299
Manchester Condition Tickets . 291
Manchester Cotton Growing Association 268
Manchester Testing House . . 291
Manchester Yarn Contract Conference, 1896 291

Medal, Association, History of . 103
Meetings, 1907 106
Meeting Committee 97
Meeting Committee, April 16, 1908 92
Meetings May be Held Outside of Commonwealth 4
Meldon, H. Merrill, Steam Turbine for Textile Mill Power . 463
Members, Alphabetical List of May 1, 1908 14
Membership, Arrangement by States, May 1, 1908 48
Membership of Association, Tabulation of 109
Membership, Total, May 1, 1908, 47
Memorial Sketches 75
Menu, Banquet, April 16, 1908 . 219
Merriam, Joseph, Elected Director for Three Years . . . 518
Merriam, Joseph, Member Resolutions Committee, April 16, 1908 99
Merriam, Mule Bands 461
Metal Output 252
Methods of Testing Lubrication in a Mill 350
Mill Heating, A. G. Hosmer . 509
Mill, Tests of Lubrication . . 350
Moisture, Percentage of . . . 284
Montgomery, J. R., Chairman Committee on Nominations, April 16, 1908 98
Montgomery, J. R., Report of Nominating Committee, April 17, 1908 496
Morison, George B., Member Dinner Committee, April 16, 1908 91
Morris, Sir Daniel, Cotton Growing in West Indies 270
Morrill, Manley G., Elected Active Member. April 17, 1908 442
Moscrop Automatic Thread Tester 321
Moulton, Alfred H., Memorial Sketch of 79
Music, Banquet, April 16, 1908 . 220
Myers, Wm., Testing of Yarns, 297

N

Name, Change of 4
Nasmith, Comber, ... 333
Nasmith, John W., Combing Short Stable Cotton 331
Nasmith, John A., Resolution of Thanks to 423
National Forest Reserve, Resolution on 423
Navaho Weaving 156
New Bedford Textile School, Custodian Scholarship Fund . 112
New Bedford Textile School, Student's Medal, 1908 . . . 104
Need and Advantages of a Cotton Exchange in New England, James R. MacColl 187
New York as a Conditioning Centre 292
New York Condition Tickets . 290
New Bedford Mill Dividends . 169
Nigeria Cotton Production . . 276
Nuzum, Harry F., Elected Associate Member. April 17, 1908, 444
Nominating Committee, April 16, 1908 98
Nominating Committee, Report of April 17, 1908 496
Normal Percentage of Moisture in Cotton 285
North Carolina College of Agriculture and Mechanic Arts, Student's Metal, 1908 . . . 104
Noyes, Arthur A., Address of Welcome, National Association of Cotton Manufacturers, April 16, 1908 119
Noyes, Arthur H., Resolution of Thanks to 423

O

Officers from First Organization, 11
Officers, Nomination of, April 17, 1908 496
Officers, Terms Expiring April 17, 1908 98
Oil Coolers for Steam Turbines 483
Oliver, E. Lomas, Spinner of Sea Island Cotton 270
Origin of Weaving 152

P

Paine, Sidney B., Member Committee on Association Medal, 1907 103
Paintings, Exhibition of Boston Art Club 97
Parish, Wm. F. Jr., Economic Possibilities of Good Lubrication 339
Parker, Walter E., Member Resolutions Committee, April 16, 1908 98
Parks, Frederic W., Elected Associate Member, April 17, 1908 444
Periodicals on File 107
Permanent Reducing Motions . 353
Peruvian Weaving 157
Peugnet, Ramsay, Elected Active Member, April 17, 1908 . . . 442
Philadelphia Textile School Student's Medal, 1908 104
Picking Egyptain Cotton . . . 202
Pierce, Moses, Established Student's Medal Fund 104
Plate, Herr, President Bemen Cotton Exchange 188
Platt's Gin 203
Plunkett, Charles T., Chairman Committee on Association Medal, 1907 103
Plunkett, Charles T., Elected President 518
Polynesian Weaving 155
Power from Steam, Merrill Meldon H. 463
Power Required for Lubrication, 343
Prehistoric Weaving 153
President's Address, Wm. D. Hartshorne, April 16, 1908 . 128
Priebsch, Robert, Elected Active Member, April 17, 1908 . . 442
Printing Rolls, Treatment of . 106
Printing Machines Represented in Association 101
Profit in Combing Waste . . . 335
Programme 84th Meeting, April 16, 1908 94
Programme Arrangements in Advance 134
Prospects, Financial, and Trade Situation, Henry Clews . . . 244
Programme of Music at Banquet April 16, 1908 220

Q

Quadrant, Swiss 315

R

Raht, Theodore Eckhardt, Received Student's Medal, 1908 104
Railroad Dividends 169
Rate Laws Declared Unconstitutional 255
Reclamation Combing Plant . . 334
Reducing Motions for Indicators 353
Regain in Cotton 290
Regulation of Steam Turbines . 480
Replacement Values 177
Report of Secretary 100
Report of Treasurer, 1908 . . . 111
Reservations of Forests, Hearing on 101
Resolutions 422
Resolutions of Thanks . . . 423

Resolutions, Committee on . . 98
Results of Changes in Lubrications 342
Rice, Richard H., Member Committee on Ballot for Members, April 17, 1908 445
Richardson, Charles H., Jr., Elected Active Member, April 17, 1908 442
Richardson, William, Elected Active Member, April 17, 1908 442
Roberts, C. E., Auditor's Report, 1908 131
Ross, John H., Elected Active Member, April 17, 1908 . . . 442
Ross, James H., Elected Active Member, April 17, 1908 . . . 442
Roof, Saw Tooth 427
Roofing Material 429
Rotor in Steam Turbines . . . 470
Russian Hand Looms 158

S

Sacks of Egyptian Cotton . . . 202
Safety Device for Steam Turbines 481
Sanford, Pardon B., Member Meeting Committee, April 16, 1908 92
Saving of Power by Changing of Oils 343
Saw Tooth Roof 427
Saw Tooth Weave Shed . . . 427
Schell, F. G., Resolution of Thanks to 423
Schell, F G., Sea Island Cotton 215
Sea Island Cotton District of . 215
Sea Island Cotton, F. G. Schell 215
Sea Island Cotton, Origin of . 215
Sea Island Cotton Originating in Barbadoes 270
Second International Conference of Master Cotton Spinners and Manufacturers, Atlanta . . . 102
Secretary's Report 99
Security of Cotton Mill Stocks . 177
Seed Cotton Improved by Storage 196
Shepard, Hon. Harvey N., Address at Banquet, April 16, 1908 224
Shepard, Harvey N., Resolution and Thanks to 423
Short Staple Cotton Combing, John W. Nasmith 331
Shuttle Box, Development of . 158
Simpson, Louis, on Draper Loom 262
Slipping to Belts 451
Smoke, Prevention of 494
Some Things a Manufacturer Should Know About Coal, E. G. Bailey 498
Southern Cotton Mill Dividends 172
Souvenir Badges 97
Speakers at Banquet, April 16, 1908 220
Spindles and Looms in England, 125
Spindle Bands, Slipping off . . 461
Spindles Represented in Association 100
Spinning and Weaving, Arts of, Wm. B. Weeden 152
Spontaneous Ignition of Coal . 490
Spray Nozzles for Cooling Air . 434
Standard of Moisture in Yarn . 286
St. Amant, George W., Member Dinner Committee, April 16, 1908 91
Statement to Stockholders . . 181
Statistics Semi-annual Cotton Stocks, Resolution on . . . 422
Stator in Steam Turbines . . . 470
Staub's Balance 314
Steadying Power and Influence of Consolidation, James Logan. 136
Steaming of Cotton 287
Steam Heating for Mills, A. G. Hosmer 509

Steam Turbine for Textile Mill Power, Meldon H. Merrill . 463
Stock Exchange, N. Y. 258
Stockholders among Employees, 179
Stocks of American Cotton, Resolution on 422
Stocks of Cotton Mills as Invesments, W. Irving Bullard . . 163
Student's Medal Committee . . 104
Student's Medal Fund, 1908 . 112
Student's Medal 104
Swiss Yarn Quadrant 315

T

Taber, William C., Memorial Sketch of 78
Takatsuji, Narazo, Elected Active Member, April 17, 1908 . 442
Tare, Arkwright, Clapp Standard, 189
Taveira, H. P., Elected Active Member, April 17, 1908 . . . 442
Technical Testing of Yarns and Fabrics, Herzfeld 312
Testing of Court 313
Testing of Steam Turbines . . 486
Testing of Yarns, Wm. Myers . 297
Tests of Moisture 285
Textile Scholarship Fund, 1908, 112
Textile Production 288
Textile Schools Receiving Student's Medal, April 16, 1908 . 104
Thomas, Edwin W., Member Nominating Committee, April 16, 1908 98
Thread Tests, Diagrams of . . 325
Tight Belts 450
Tilton, Newell W., Elected Associate Member April 17, 1908 444
Tolman, James P., Hearing at Washington on Forest Reservations, 1908 132
Tolman, James P., Member Dinner Committee, April 16, 1908, 91
Tompkins, D. A., Exportation of Cotton 168
Tompkins, Daniel A., Member Nominating Committee, April 16, 1908 98
Transactions of Other Associations 107
Transmission of Belts, Charles F. Chase 446
Transportation of Testing Instruments in India 349
Transportation of Testing Instruments in Ireland 349
Treasurer's Report, 1908 111
Trial Balance, 1908 111
Tuft's College, President of, Address at Banquet, April 16, 1908 228
Turbine, Steam, Merrill H. Meldon 463
Turbines, Steam, See Engines, Steam . . . . . .

U

Uebel, Frederich, Elected Active Member, April 17, 1908 . . . 442
U. S. Exports, Cotton Goods . 252
Unconstutionality of Rate Laws, 255

V

Value of Coal 493
Value of Sea Island Cotton . . 217
Variations from Reputed Count, 307
Variations in Count 299
Variations in Yarn Strength . . 329
Ventilation and Construction of a Weave Shed, Samuel M. Greene 426
Vienna Report, International Cotton Congress 93
Vogl, Frank P., Memorial Sketch of 79

W

Waeffler, Arthur, Hank Table . 306
Warehouse Cotton Certificates . 192
Waste, Cost of Combing . . . 335
Water Gland for Steam Turbines, 484
Weave Shed, Construction and Ventilation of, Samuel M. Green 426
Weaving and Spinning, Arts of, Wm. B. Weeden 152
Webber, Bertrand A., Elected Active Member, April 17, 1908, 442
Webber, Col. Samuel, Memorial Sketch of 80
Webber, Col. Samuel, Resolutions to 105
Webb, Wright, Elected Associate Member, April 17, 1908, 444
Welcome, Address of, National Association of Cotton Manufacturers, Arthur A. Noyes, April 16, 1908 119
Welcome to the Commonwealth, April 16, 1908, Eben S. Draper, 124
Weeden, Wm. B., Arts of Weaving and Spinning 152
Weeden, Wm. B., Resolution of Thanks to 423
Weight of Egyptain Cotton . . 204
Weight of Hanks, Table, Draper, 308
West Africa, Cotton Cultivation in, Wm. Howarth 267
West African Cotton Exportation 274
West, Alexander S., Elected Associate Member, April 17, 1908 444
West Indies, Exportation of Sea Island Cotton 270
West, William R., Elected Active Member, April 17, 1908 443
Westerman, William T., Member Nominating Committee, April 16, 1908 98
Westinghouse-Parsons Turbine, Merrill, Meldon H. 463
White, John H., Elected Active Member, April 17, 1908 . . 443
Whitin, G. Marston, Member Meeting Committee, April 16, 1908 92
Whitman, Wm., Inviolability of Mercantile Obligations . . . 237
Whittaker, John G., Elected Active Member, April 17, 1908, 443
Wild, John B., Member Resolutions Committee, April 16, 1908 99
Wilde, Paul C., Elected Active Member, April 17, 1908 . . . 443
Wilson, James, Secretary of Agriculture, Story of Storage of Seed Cotton 196
Willey, Arthur L., Elected Active Member, April 17, 1908 . 443
Willingham, Broadus E., Member Resolutions Committee, April 16, 1908 99
Wood, John P., Member Resolutions Committee, April 16, 1908 99
Woodbury, C. J. H., Hearing on Forest Reservation, Washington, 1908 132
Woodbury, C. J. H., Secretary's Report 100
Woodbury, C. J. H., Treasurer's Report, 1908 111
Wool Crop, Marketing of . . . 194
Wrap Reel 298

Y

Yarn Assorting Balance, Knowles, ... 304
Yarn Balance, Staub's 314
Yarns, Cotton, Conditioning of Robert J. Hoguet 284
Yarns, Damping of 287
Yarn, Standard of Moisture . . 286
Yarns, Testing of, Wm. Myers . 297

HOWARD & BULLOUGH,

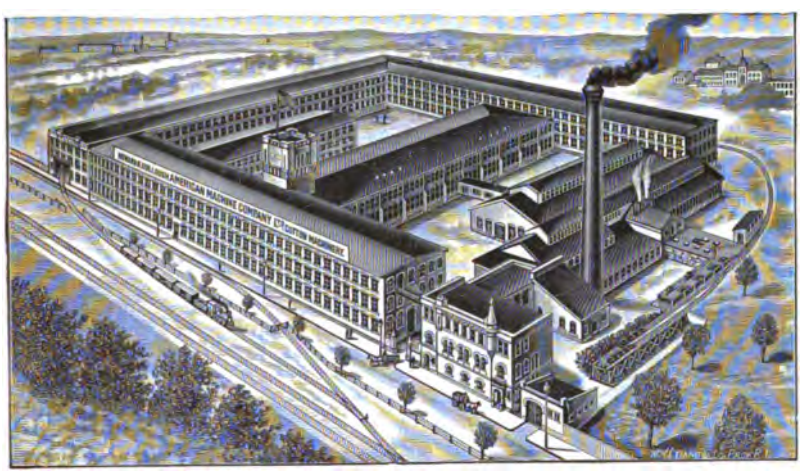
AMERICAN MACHINE COMPANY, LTD.

PAWTUCKET, R. I.

C. E. RILEY, Treas.
65 Franklin Street,
Boston, Mass.

Southern Offices:
814-815 Empire Bldg.,
Atlanta, Ga.

COTTON MACHINERY



Hopper Bale Openers
Feeders
Self Feeding Openers
Breaker, Intermediate and Finisher Lappers.
Revolving Flat Cards
Drawing Frames
Slubbing, Intermediate and Roving Frames.

Improved New Pattern Spinning Frames
Twisters for Wet or Dry Work
Cone Winders.

Warpers and Slashers.

Send for Descriptive Circulars with lists of users.

WE INVITE YOUR INVESTIGATION AND COMPARISON.

FOR a Fly Frame that will give you a large production at small amount of cost and horse power, go to the WOONSOCKET MACHINE & PRESS COMPANY, Woonsocket, R. I. They also manufacture Cloth Trimmers, Shafting, Hangers, Pulleys, Friction Clutches, &c.

"AMERICAN"

The Operating Expense of Rope Transmission
vs
Electrical Transmission

To support our widely-advanced claim for the superior efficiency of "American" Transmission Rope over any other known means for the transmission of power, we offer the following emphatic statement:

"We will guarantee to any Cotton, Woolen or similar mill using 500 horse-power or more, a saving of twenty-five per cent. in favor of rope drives over any electrical equipment that can be installed, the same engine being used for both transmissions. Further, in case we fail, we will remove our apparatus without expense to the mill owner, and pay a forfeit of $10,000, to cover loss and inconvenience to the company making the trial, provided any concern furnishing electrical appliances will take the other side of the proposition and duplicate this offer."

Write for our "Blue Book of Rope Transmission." It gives full information on the design, erection and care of rope drives.

The American Manufacturing Co.,
Manila, Sisal and Jute Cordage
65 WALL STREET, NEW YORK CITY
Largest fibre workers in the world.

TRANSMISSION ROPE

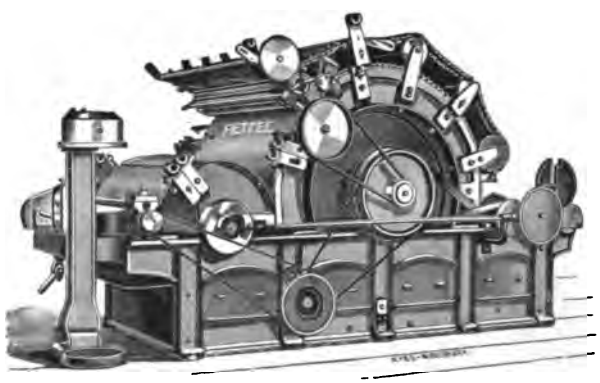
Saco AND Pettee Machine Shops.

Main Office, NEWTON UPPER FALLS, MASS.

COTTON MACHINERY

OF THE

LATEST IMPROVED PATTERN.



Revolving Flat Cards, Slubbing,
Railway Heads, Intermediate,
Drawing Frames, Roving,
Spoolers and Reels, Spinning Frames.

SHOPS: . . . { Biddeford, Maine.
Newton Upper Falls, Mass.

Southern Office, - - - CHARLOTTE, N. C.

A. H. WASHBURN, Agent.

☞ Send for estimates and prices.

83—84T. F.

STODDARD

IMPORTERS OF
COTTON, SILK, WORSTED, WOOLEN AND FIBRE MACHINERY, MILL SUPPLIES, EGYPTIAN COTTON and BURLAPS.

SOLE AMERICAN REPRESENTATIVES FOR
DOBSON & BARLOW, LTD.
New Hopper Bale Breakers, Pickers, Cards, Combers, Fly Frames, Mules, Gassers, etc. Improved Worsted Carding Engines.
PRINCE, SMITH & SON.
Gilling, Noble Combs, Drawing Roving, Spinning, Twisting and Reeling Machinery.

HASERICK

SOCIETE ALSACIENNE de CONSTRUCTIONS MECANIQUES de MULHOUSE,
Alsatian Cotton Combers, Slashers, for Fine Warps, French Worsted Machinery.
SAMUEL LAW & SONS, LTD.
Card Clothing of Every Description.
WM. WHITELEY & SONS, LTD.
Mules, Tentering Machines, Warpers, Mercerized Machinery, Etc.
E. HOYLE & SONS, LTD.
Dyeing and Finishing Machinery, Hydraulic Presses.
HARDING, RICHARDSON, RHODES & CO., LTD.
Gill and Combing Pins, Needles.
SAMUEL ROWBOTTOM.
Spindle Bands and Tapes.

RICHARDS

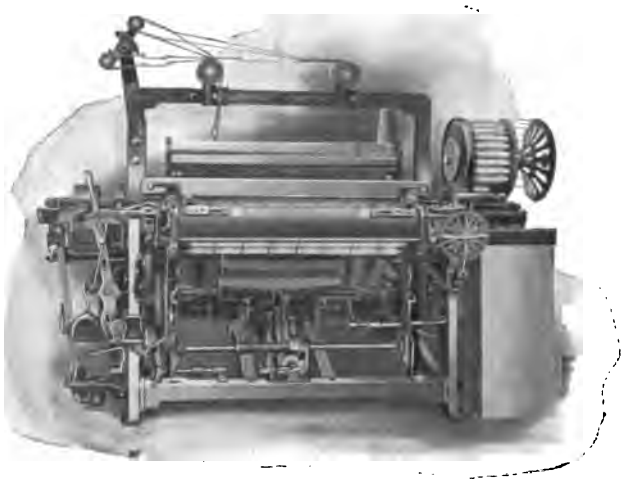
JOHN DIXON & SONS.
Mill Bobbins.
J. PARKINSON.
Loom Temples.
J. KAYE & SONS, LTD.
Patent Oil Cans.

Mill Supplies German Tempered Steel Wire Heddles, Persian Roller Skins, Worsted Doup Twine, Leathers. **Hard Roller Covers**
GILL & COMB, Aprons, Etc.

& CO.

152-8 Congress St., Boston, 8 Currer St., Bradford, Eng.
Offices: "The Arcade," Philadelphia, Pa.
Charlotte, N. C.

EGYPTIAN COTTON,
CARVER BROS. & CO., Ltd.
Alexandria Manchester Liverpool London



THE REAL AUTOMATIC

NORTHROP LOOM

Built by

Draper Company,

In Rather Large Quantities
at

HOPEDALE, MASS.

The Dodge Manufacturing Co.

ENGINEERS. FOUNDERS. MACHINISTS.

Mishawaka, Ind.

BRANCHES:

137-139 Purchase Street, BOSTON. Cedar and Washington Streets, NEW YORK. 163-167 S. Clinton Street, CHICAGO.
128 W. 3rd Street, CINCINNATI. 522 Chemical Bldg., ST. LOUIS, MO.

Modern Textile Mill Equipments

Embracing Latest Improved Devices Embodying Highest Efficiency in Power Transmission Engineering.

The "Dodge" American System Rope Transmission.

The Eureka Water Softening and Purifying Apparatus

FOR STEAM PLANTS AND INDUSTRIAL PURPOSES.

Soft Pure Water for Railroads, Breweries, Tanneries, Cotton Mills, Print Works, Woolen Mills, Bleacheries, Laundries, Dye Houses.

CAPILLARY SELF-OILING BEARINGS—Oil Economizers.
IRON CENTER WOOD RIM TEXTILE PULLEYS, (Designed for Textile Mill Work)
COUPLINGS,—In Variety.

SAFETY IRON CENTER WOOD RIM FLY WHEELS.
IRON SPLIT AND SOLID PULLEYS, SHAFTING, ETC.

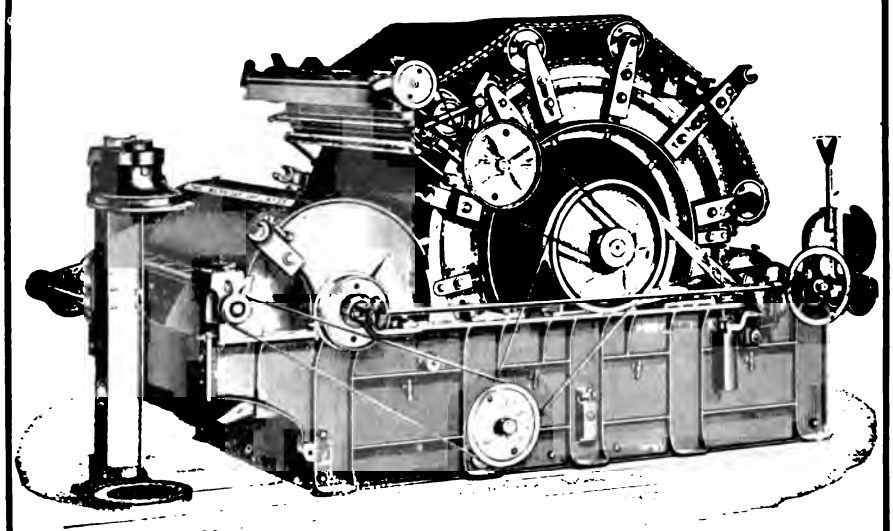
We have a large engineering force and will be pleased to assist you in the determining of your requirements in our line upon receipt of data stating just what you desire to accomplish. **Address Nearest Office.**

83—84 T. F.

LOWELL

Cotton Machinery

of every description, from the
Card to the Baling Press



REVOLVING FLAT TOP CARD

COTTON MACHINERY — Cards, Railway Heads, Drawing Frames, Roving Frames, Ring Frames, Spoolers, Warpers, Slashers, Looms, Twisters, Reels, Shearing Machines, Brushing Machines, Folders, Cloth Stamping Machines, Baling Presses, Size Kettles, Etc.

WORSTED MACHINERY — Spinning Frames, Twisters, Dandy Rovers and Reducers, Gill Boxes, Etc.

Lowell Machine Shop

Lowell, Mass.

"KITSON PRODUCTS"

Blowing Systems,

For Conveying Bale Cotton
from Storehouse to Picker-room.

Self-Feeding Openers,
Lappers and
Cleaning Trunks.

Waste Working Machinery.

Raw Stock Cotton Dryers.

We own the patterns and can furnish REPAIR PARTS for PICKERS formerly built by

WHITEHEAD & ATHERTON
LOWELL, MASS.

ATHERTON MACHINE CO.
LOWELL, MASS.

A. T. ATHERTON MACHINE CO.
PAWTUCKET, R. I.

KITSON MACHINE SHOP,

LOWELL, MASS.

Is Your Business Growing?

The question of enlarging manufacturing capacity to meet the demands of increasing business is becoming a pressing one with many manufacturers.

In these circumstances it is of importance that the mills should have been laid out with a view to future expansion, and in no place is this more true than in the power plant.

The matter of providing for future growth in this department has been greatly simplified by the adoption of Rope Drives as a means of conveying power. Our booklet on "Power Transmission" takes up this point and describes the many other advantages of rope transmission.

Do You Use PLYMOUTH Baling Rope?

Plymouth Cordage Company

North Plymouth, Mass.

C. E. RILEY COMPANY

65 Franklin Street, Boston, Mass.

Builders and Importers of

Cotton

Woolen

Worsted

Machinery

Egyptian Cotton

PEEL & CO., Alexandria

COTTON GOODS

AND

COTTON YARNS

The Greatest Textile Library In The World

The Textile Volumes of the International Library of Technology are without doubt the finest reference library on textile subjects in the world. These volumes form part of a library which cost $1,500,000 to prepare. It was written by some of the best experts in the world and has been edited by the staff of experts of the International Correspondence Schools in a manner that is concise and thorough, but remarkable for its simplicity. The textile library consists of six volumes, 6 × 9 inches in size and about 1¾ inches thick. It contains about 4,000 pages of text and 2,000 illustrations.

The First Volume of this Library contains authoritative information on cotton pickers, cotton cards, drawing rolls, combers, and fly frames; the Second Volume, ring frames, cotton mules, twisters, spoolers, warpers, slashers, and chain warping; the Third Volume, yarns, cloth rooms, mill engineering, reeling, baling, and winding; the Fourth Volume, wool scouring, drying, burr picking, mixing, carding, spinning, and warping; the Fifth Volume, cam, fancy, and automatic looms, dobbies, box motions, leno attachments, and jacquards; the Sixth Volume, weave glossary, fabric analysis, weave varieties, and color designs.

We have a special offer on these Volumes that will interest mill officials. Write for it today.

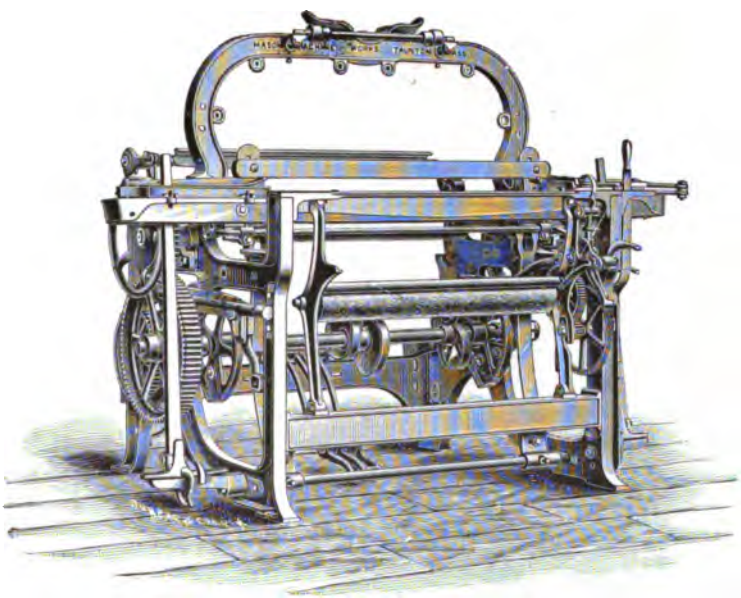
INTERNATIONAL TEXTBOOK COMPANY
SCRANTON, PA.

MASON MACHINE WORKS,

TAUNTON, MASS.

—— BUILDERS OF ——

COTTON MILL MACHINERY.



REVOLVING FLAT CARDS,
COMBING MACHINERY,
DRAWING FRAMES,
SPINNING FRAMES,
MULES AND LOOMS.

Southern Office Address:

MASON MACHINE WORKS,

CHARLOTTE, N. C.

84—85 T. F.

HORIZONTAL or VERTICAL

SIMPLE, COMPOUND or TRIPLE EXPANSION

STEAM ENGINES.

38″ × 78″ × 56″

7,500 Horse-Power Double Horizontal-Vertical Compound Engine,

With 5,000-K. W. Direct Driven Alternating Current Generator.

Speed, 94 Revolutions per minute.

McINTOSH, SEYMOUR & Co., Auburn, N. Y.

Boston Agents:

J. A. GRANT & CO., 1002 Tremont Building.

GRINNELL WILLIS & CO.

SELLING AGENTS

44-46 Leonard Street

NEW YORK

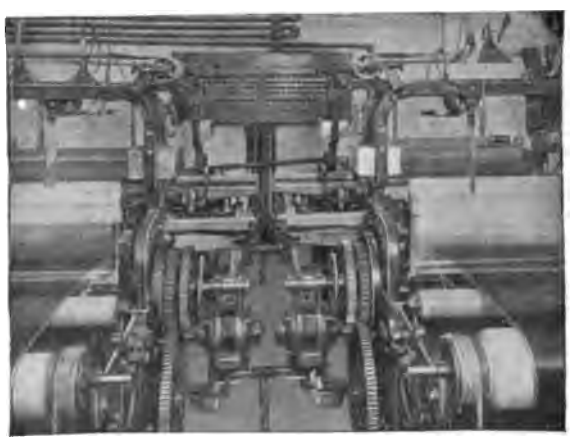
BROWN	SHEETINGS
	SHIRTINGS
	INTERLININGS
AND	DRILLS
	LONG CLOTHS
BLEACHED	CAMBRICS
	LAWNS and
	NAINSOOKS

FOR HOME AND EXPORT MARKETS

SPECIAL FINISHES AND PACKING
FOR THE EXPORT TRADE.

General Electric Company

Individual Motor Drive for Textile Machines



½ Horse Power Induction Motors Driving Looms.

Individual Drive means a Profitable Drive

It reduces—

- Cost of building
- Operating expenses

It eliminates—

- Belts, shafting, ropes
- Useless friction losses

It insures—

- Increased output
- Improved product

Mill specialists of 15 years' experience are at customers' service

Principal Office: Schenectady, N. Y.

Mill Power Department,
84 State St., Boston, Mass.

Sales Offices in All Large Cities.

1663

The Whitin Machine Works,

WHITINSVILLE, MASS.

BUILDERS OF

COTTON MACHINERY,

Cards,	**Combing Machines,**	**Twisters,**
Railway Heads,	**Drawing Frames,**	**Reels,**
Sliver Lap Machines,	**Spinning Frames,**	**Long Chain Quillers,**
Ribbon Lap Machines,	**Spoolers,**	**Looms.**

SOUTHERN AGENT:

STUART W. CRAMER, - Court House Square, Charlotte, N. C.

AND CANDLER BUILDING, ATLANTA, GA.

Harding, Whitman & Company

FINE COTTON GOODS

COTTON YARNS

WORSTED YARNS

Mercerized Yarns

WORSTED DRESS GOODS

WORSTED TOPS

WORSTED ROVINGS

Boston **New York** **Philadelphia**
Chicago **St. Louis** **Baltimore**
Charlotte **Atlanta**

DANKER & MARSTON

D & M GUM

For sizing and finishing Cotton, Silk and Wool.

D & M BLEACHING ASSISTANT

For preparing Cotton Stock, Yarn, Knit and Piece Goods for the chlorine.

D & M EGYPTIAN TINT

Producing identical shade of straight Egyptian Cotton; runs absolutely uniform, and is in use by the leading concerns of the country.

D & M SOFTENER

White, strictly uniform and with exceptional softening properties.

D & M BLEACHERS' BLUE

Producing a permanent blue-white tint on Bleached Goods, one not affected by heat, metals, climatic conditions or age.

D & M COLORS

Special products for direct dyeing of Cotton Goods, and the printing of Cotton, Silk and Woolen Fabrics.

D & M FINISHING PRODUCTS

Our specialties for finishing Cotton, Silk, Woolen and Worsted Goods are in use by the leading mills of the United States.

247 Atlantic Avenue

BOSTON

84—85

Progressive Manufacturers have found out that the

Improved Governor for Water Wheels

Saves Them Money and makes their goods much nearer perfection.

INSTALLED ON A SIXTY DAYS' TRIAL.

HOLYOKE MACHINE CO., Worcester, Mass.

83—84

SALEM ELEVATOR WORKS,

CHARLES F. CURWEN, Proprietor.

SALEM, - MASS.

ELECTRIC AND BELT POWER

ELEVATORS.

Over 1000 in Use in Textile Plants Alone.

AUTOMATIC HATCH DOORS,
SELF-CLOSING LOCK SAFETY GATES.

Send for Illustrated Catalogue. ELEVATOR ROPES.

83—84

PHILADELPHIA
TEXTILE SCHOOL.

[PENNSYLVANIA MUSEUM AND SCHOOL OF INDUSTRIAL ART.]

Strongly Endorsed in Europe and America because of its Practical Methods and Equipment, and Unexcelled Results.

Instruction includes Carding, Spinning, Designing, Dyeing, Weaving, Finishing and Industrial Chemistry as applied to Cotton and Wool, and Worsted and Silk.

TWENTY-FIFTH YEAR

Day Classes Open September 28, 1908.
Evening Classes Open October 5, 1908.

Descriptive Literature Sent on Application to

EDWARD W. FRANCE, Director, Broad and Pine Sts., Philadelphia.

83—84

General Fire Extinguisher Co.

Manufacturers, Jobbers, and dealers in PIPE, FITTINGS, VALVES, HYDRANTS, and all kinds of Steam, Gas and Water Supplies and Specialties.

Factories and Warehouses equipped with the GRINNELL AUTOMATIC SPRINKLER, on the Wet Pipe or Dry Pipe System, as may be desired.

The Grinnell Dry Pipe System affords thorough protection all the year around for buildings in which the water in a Wet Pipe System would freeze.

DEPARTMENT AGENCIES:

PROVIDENCE, Union Trust Building.
BOSTON, Post Office Square Building.
NEW YORK, Trinity Building.
BUFFALO, 67 Dun Building.
PHILADELPHIA, Mutual Life Building.
PITTSBURG, Machesney Building.
CLEVELAND, Society for Savings Building
CINCINNATI, Union Trust Building.
ST. LOUIS, Lincoln Trust Building.
ATLANTA, GA., 276 Marietta St.
CHARLOTTE, N. C., North College St.
NEW ORLEANS, LA., Canal & No. Claiborne Sts.
CHICAGO, Royal Insurance Building.
MONTREAL, 620 St. Paul Street, West.

Information and proposals furnished at the Several Department Agencies, and at the

Executive Offices, PROVIDENCE, R. I.

83—84

F. P. SHELDON & CO.

MILL
STEAM
HYDRAULIC
ELECTRICAL
ENGINEERS.

6,000,000 Cotton Spindles.
20,000,000 Square Feet of Buildings.
300,000 H. P. Installations.

INDUSTRIAL TRUST BUILDING,
PROVIDENCE, R. I.

83—84 T F.

Trade Mark.

WE MAKE THE **BEST**

FIRE HOSE

FOR PROTECTING

Cotton Mills, Woolen Mills and Factories.

The Eureka "U. S. Underwriters" cotton rubber-lined, and "Eureka Underwriters' Best Linen" hose are made strictly in accordance with the requirements and specifications of the Associated Factory Mutual Fire Insurance Companies and National Fire Protection Association.

Eureka 4-Ply Fire Hose.

HOSE OF EVERY DESCRIPTION.

Sole Manufacturers of the Celebrated Brands:

EUREKA 4-Ply. **PARAGON** 3-Ply. **RED CROSS** 2-Ply.

SAMPLES AND FULL INFORMATION ON APPLICATION.

EUREKA FIRE HOSE COMPANY,

13 Barclay Street, - - NEW YORK.

83—84

Cell Drier Machine Co.

Taunton, Mass.

(Formerly Vacuum Process Company.)

Announces the Completion of its Fully Equipped Manufacturing Plant at Taunton, Mass., where it is Building Cell Driers for many of the Leading Mills.

Send for Photographs and Bulletins.

83—84

Problems in Dyeing

WE are prepared to dye any shade upon any fabric submitted, or we will match any required shade and submit exact dyeing directions. Information of a technical nature cheerfully given. No charge is made for such service, and in accepting it there is no obligation to purchase from us anything that you can buy or that you think you can buy to better advantage elsewhere

Cassella Color Company

182-184 Front Street: New York

BRANCHES:

BOSTON, 68 Essex Street — PHILADELPHIA, 126-128 S. Front Street

PROVIDENCE, 64 Exchange Place — ATLANTA, 47 N. Pryor Street

MONTREAL, 59 William Street.

83—84

CARD CLOTHING

of our manufacture is now being used in the largest cotton mills throughout this country. . . . .

GET IN TOUCH WITH US BEFORE PLACING YOUR NEXT ORDER.

Also All Kinds of WIRE HEDDLES.

HOWARD BROS. MFG. CO.,

44 & 46 VINE ST., WORCESTER, MASS.

83—84

HENRY ASHWORTH. C. M. CLARK. R. C. ASHWORTH.

ASHWORTH BROS.

MANUFACTURERS OF

CARD CLOTHING

SPECIALTIES:

Clothing for Revolving Flat Cards.
Napper and Brusher Clothing.
Top Flats Clothed with Improved Steel Clamps.

89 GLOBE MILLS AVENUE, - - FALL RIVER, MASS.

SOUTHERN AGENCY:

W. H. BIGELOW, No. 12 West Fourth St., Charlotte, N. C.

83—84 T. F.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

Northeastern Department

C. E. ROBERTS, Manager.

101 MILK STREET BOSTON, MASS.

83—84

EGYPTIAN, COTTON PERUVIAN.

THE S. BLAISDELL, Jr., COMPANY.

American Long Staple a Specialty. Shipments Direct to Mill from Egypt, Peru and all American Southern Points.

COTTON WASTE Purchased on Yearly Contracts From Mills.

CHICOPEE, - - MASS.

83—84

T. C. ENTWISTLE COMPANY,

FRANK B. KENNEY, Manager, **LOWELL, MASS.**

Patent Warping, Balling, and Beaming MACHINES.

PATENT EXPANSION COMBS FOR WARPERS, BEAMERS AND SLASHERS, TRAVERSE WHEEL AND ROLL GRINDERS.

STUART W. CRAMER, Southern Agt., Charlotte, N. C.

83—84

THOMAS LEYLAND & CO.

60 INDIA STREET, BOSTON, MASS.

T. F. WALSH, MANAGER.

Importers, Manufacturers and Dealers:

Gums,	Sizes
Dextrines,	Softeners,
Starches,	Turkey Red Oils,
Finishing Gums,	Alizarine Assistants,
Soluble Starches,	Dyewood Extracts.

SOLE AGENTS AND MANUFACTURERS OF

The William Mycock Patent Regulating Cloth Expander, Scutchers, Guides, Piece End Sewing Machines.

83—84

CHAS. T. MAIN,

(Formerly of DEAN & MAIN,)

Mill Engineer and Architect,

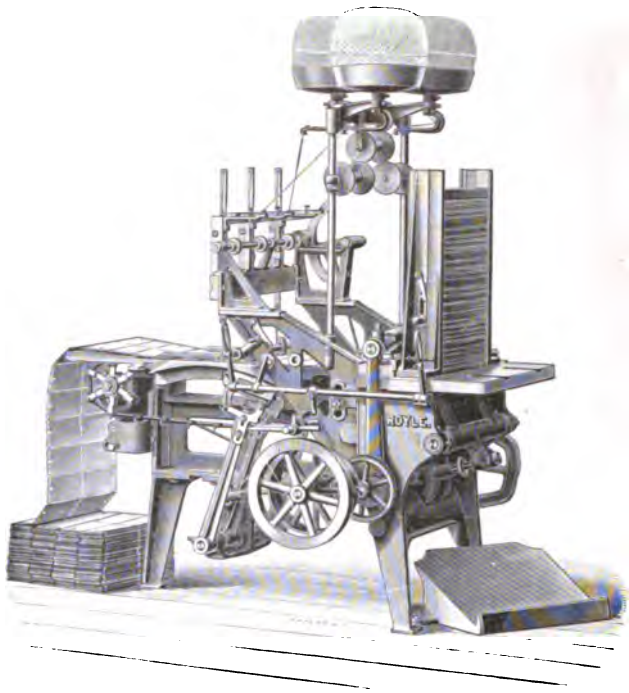
911 INTERNATIONAL TRUST BUILDING, 45 MILK ST.,

BOSTON, MASS.

Plans, Specifications and Supervisions for Construction and Reorganization of Textile Plants; Valuations of and Reports on Manufacturing Properties.

83—84

CARD ROOM ECONOMY.



Cut, Lace and Repeat your Jacquard Cards with the Royle Machinery. No other way does it more quickly; and the results are accurate, and therefore, dependable.

REPEATERS,

LACERS

and

PIANO MACHINES

Are built for either scale.

JOHN ROYLE & SONS,

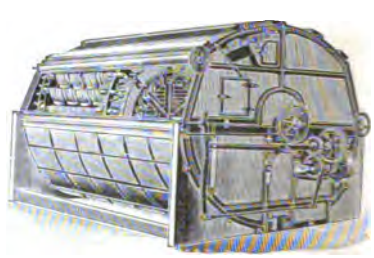
Paterson, N. J., U. S. A.

84—85

THE KLAUDER-WELDON DYEING MACHINE CO.,

AMSTERDAM, N. Y.

RAW COTTON DYEING MACHINE.



COTTON SKEIN DYEING MACHINE.

Are Prepared to Install in Cotton Mills, on SIXTY DAYS' TRIAL,

DYEING MACHINES FOR RAW COTTON OR COTTON SKEINS

Guaranteed to Produce RESULTS Satisfactory to the Purchaser.

84—85

SPINNING AND TWISTER RINGS

OF EVERY VARIETY.

But Only One Quality—THE BEST.

Our Burnished Rings are the lightest running and most durable Rings ever produced.

Double Ribbed Rings are made exclusively by us.

Our U. S. Standard Traveler Cleaner is the acknowledged leader among Traveler Cleaners.

Economize in Travelers by using **Our Popular New Traveler Cup.**

Whitinsville Spinning Ring Co.

Whitinsville, Mass., U. S. A.

83-84

New Bedford Textile School.

Day and Evening Instruction

IN PICKING, CARDING, COMBING, SPINNING, WARP PREPARATION, WEAVING, DESIGNING, KNITTING, CHEMISTRY, AND DYEING.

CATALOGUE ON APPLICATION.

ADDRESS.

H. W. NICHOLS, Supt.,

New Bedford Textile School,

New Bedford, Mass.

84—85 T. F.

LOCKWOOD, GREENE & CO.,

ARCHITECTS AND ENGINEERS FOR INDUSTRIAL PLANTS.

BOSTON, MASS. **GREENVILLE, S. C.**

The oldest engineering firm of its kind in the United States, numbering among its clients the most successful manufacturing concerns.

84—85

SAVOGRAN

Is responsible for many acres of

Clean, Sweet Mill Floors.

INDIA ALKALI WORKS,

28-37 India Wharf,

BOSTON, - - MASS.

84—85

THE J. R. MONTGOMERY CO.

WINDSOR LOCKS, CONN.

MERCERIZED COTTON WARPS

Showing Highest Possible Silk Lustre.

High Grade Cotton Warps AND Novelty Yarns.

Printers of Cotton, Wool, and Worsted Yarns.

84—85 T. F.

C. R. MAKEPEACE & CO.

Mill Architects and Engineers.

PLANS AND SPECIFICATIONS Furnished for the Construction and Equipment of Cotton, Woolen and Worsted Mills. Bleaching and Dye Works. Old Mills Reorganized and Extended.

BUTLER EXCHANGE,

PROVIDENCE, - - R. I.

84—85 T. F.

OVERSEERS AND SUPERINTENDENTS,

Mark your Yarn with **Lowell Mill Crayons**

and you will not be troubled with cloth damaged by using poor crayons.

CAN WE SERVE YOU?

LOWELL CRAYON CO.,

Original Manufacturers,

Lowell, Mass.

Write for Sample Card showing Colors and Prices.

84—85 LOOK FOR TRADE MARK ON EVERY 5 LB. BOX.

Dinsmore Manufacturing Co.

(ESTABLISHED 1874.)

SALEM, - - MASS.

Mill Sewing Machines

AND SUPPLIES.

13 Different Styles of Machines.

For Cotton and Woolen Mills, Bleacheries, Print Works, Silk Mills, Etc.

Over 4,000 in Use.

CHAS. F. CURWEN, Treasurer.

Send for Illustrated Catalogue.

83—84

EVAN ARTHUR LEIGH,

Successor to E. A. LEIGH & CO.

232 Summer Street, - BOSTON, MASS., U. S. A.

——IMPORTER OF——

Textile Machinery, Etc.

Sole Agent for the United States and Canada for

PLATT BROS. & CO. (Ltd.) of OLDHAM, ENGLAND,

By far the largest Makers in the World of

COTTON, WOOLEN AND WORSTED MACHINERY.

By the use of Platt's Cotton Machinery for either fine or coarse work, a larger production of better quality can be obtained at less cost.

Sole Makers of Brown's Patent Carding Engines for Wool—gives woolen yarn a worsted appearance.

Special Machinery for making English and French Worsted Yarns.

Special Machinery for making Cotton Waste into Yarns.

Platt's Woolen and Worsted Cards — special designs.

Platt's Mules for Cotton, Woolen and Worsted.

Machinery for Gassing and preparing Cotton, Worsted and Silk Yarns.

Joseph Sykes Brothers' Card Clothing for Cotton. **Jas. Critchley & Sons'** Clothing for Woolen and Worsted. **Dronsfield's** Grinding Machinery and Emery Filleting

George Hodgson's Looms for Worsted, etc.

Mather & Platt's Dyeing and Finishing Machinery.

Archbutt-Deeley System for Purifying and Softening Water.

Textile Machinery Association's Machinery for Flax, Hemp, Jute, etc.

Patent Automatic Feeding Machine Co.'s Feeders for all classes of fibres.

Haigh's Double Loop Bands and Driving Tapes.

84—85

"A LOOM FOR EVERY FABRIC"

No branch of the textile industry has received so much careful attention as has been given to the machinery for weaving.

Crompton & Knowles Looms have maintained the supremacy gained many years ago.

Every weaver is familiar with them.

CROMPTON & KNOWLES

LOOM WORKS

Worcester — Providence — Philadelphia

Sole Makers
OF
Jacobs' Pat. Roller Cushion Lug Strap
Jacobs' Pat. Verybest Lug Strap

Eclipse Lug Strap,
Knock 'Em Out Lug Strap,
Canvas Back Lug Strap,
Star Lug Strap,
X. X. C. Y. Tail Pickers,
Jersey Oak Tail Picker,
Surpass W.X. Picker,
Daisy Picker,
Jacobs' Diamond Picker Loops.
Jacobs' Braided Cord Dobby Straps.

Free Samples to Anyone Anywhere on earth.

E. H. JACOBS MFG. CO.

DANIELSON, CONN.

84—85

Manufacturers should look up the advantages of the

METALLIC DRAWING ROLL

Over the leather system before placing orders for new machinery, or if contemplating an increase in production, have them applied to their old machinery.

25 Per Cent. More Production GUARANTEED.

SAVES

Roll Covering,
Varnishing,
Floor Space,
Power,
Waste and Wear.

ONE-THIRD LESS WEIGHT REQUIRED.

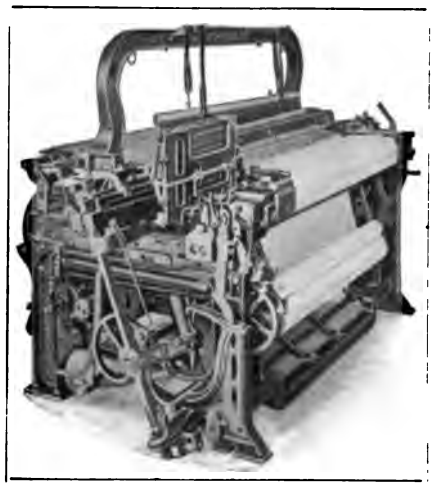
Write for Points Claimed, also Prices and Particulars, to

The Metallic Drawing Roll Co.,

INDIAN ORCHARD, MASS.

84—85

"IDEAL" Automatic Loom



AND

LOOMS OF ALL KINDS

For the Manufacture of Cotton and Silk Fabrics;

Dobbies, Warp Stop Motions, Fancy Weaving Motions, Temples, Etc.

THE STAFFORD COMPANY,

READVILLE, MASS.

84—85

LOWELL TEXTILE SCHOOL.

Scientific and Practical Training in all Processes of Textile Manufacture, including all Commercial Fibres.

Complete Courses of Instruction in
Cotton Manufacturing,
Wool Manufacturing,
Textile Designing,
Chemistry and Dyeing,
Textile Engineering.

Courses include Instruction in Mechanism, Mechanical Drawing, Mathematics, Physics, Chemistry, Steam and Electrical Engineering, Language and Decorative Art.

New and complete equipment for machine shop practice and engineering laboratory.

Theory supplemented by thorough practical instruction in machine rooms and laboratories.

Graduates of high schools and academies admitted with certificate. Graduates of colleges and scientific schools admitted to advanced standing.

For catalogue Address **Charles H. Eames, S. B., Principal, Lowell, Mass.**

84—85